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ORIGINAL MEMOIRS.

CEPHALIC TETANUS.*

WITH REPORT OF A CASE.

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OUR knowledge of the unusual form of tetanus variously known as cephalic tetanus, kopftetanus, and tetanus hydrophobicus is still so imperfect as to render desirable reports of individual cases, in the endeavor to ascertain the causation of so peculiar a clinical type of an otherwise well-known general disease.

The recognition and first description of the disease is usually ascribed to Rose,[1] by whom the name tetanus hydrophobicus was given; his priority has, however, been disputed by Eastman,[2] who gives the credit for the first description of the condition to Bell.[3] At present the term cephalic tetanus is applied to those cases which present a paralysis or paresis of one or more of the cranial nerves as a prominent symptom, together with more or less well-marked symptoms of tetanus, generally confined to the region of the head and neck, though at times involving the entire body. Some authors have classified the condition as chronic tetanus on account of its usually

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long incubation period, but this is by no means invariably characteristic of this form. Others have classed as cephalic tetanus all cases in which the wound of entry has been on the head, irrespective of the symptoms presented. The cases mentioned here belong to the class above referred to, in which paresis or paralysis of one or more of the cranial nerves is present.

The disease is apparently very rare in the United States. Eastman [2] mentioned three cases as all he found reported in the literature up to 1907, and added three more. I have been unable to find any additional cases reported in this country to date.

The following case, the seventh reported in the United States, was seen by me in consultation with Dr. H. D. White, of Rome, New York, and through his courtesy I am permitted to report it.

CASE I.—C. R., male, farmer, aged forty years. His family and previous histories throw no light on his present trouble.

On Monday, September 6, 1909, the patient was struck over the right temporofrontal region by the tine of a mechanical manure spreader, which caused a lacerated wound of the forehead. The blow was severe enough to knock him down, and he thinks he was unconscious for a few minutes, was dazed for an hour or two, and suffered from a severe headache for the remainder of the day. The wound was cleansed and dressed by Dr. White; it was found to extend down to and at one point through the periosteum, but there was no evidence of fracture of the skull. The following day the patient felt practically well, and went about his work as usual on that day and on the day following. On Thursday, three days after the accident, the patient noticed that he could not perfectly control the right side of his mouth while eating and particularly when trying to take fluids. This was followed on the next day by twitching of the muscles of the left side of his face, which increased in severity, and soon tonic spasms of the muscles of mastication of both sides supervened, giving rise to a marked trismus. There were no constitutional symptoms and the patient did not feel sick in any way. The muscular spasms became so severe that six days after the acci-

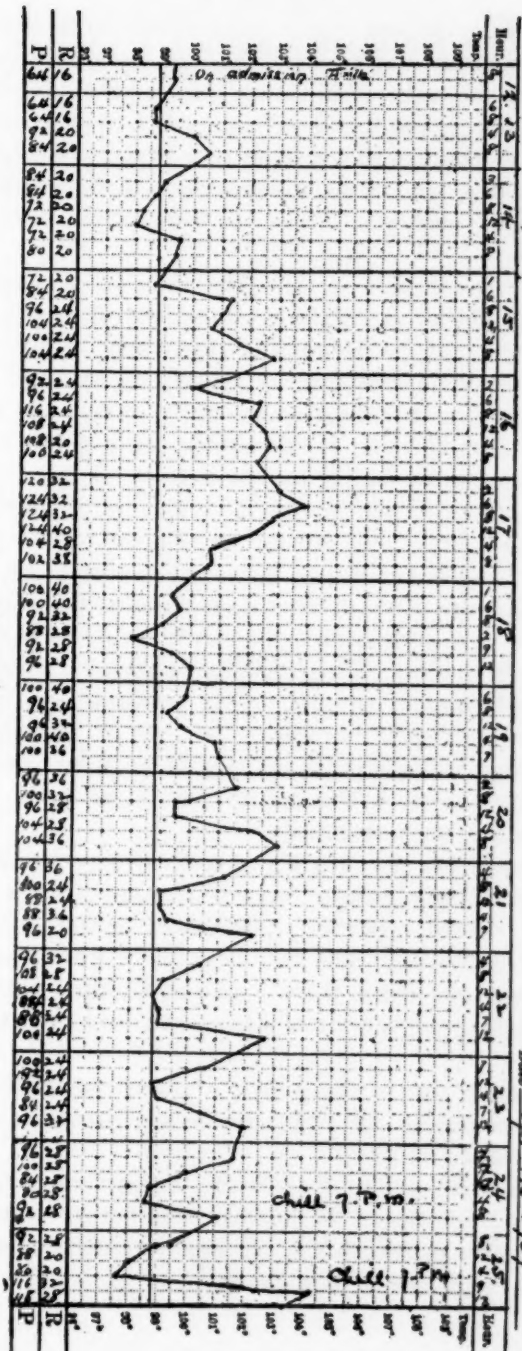


CHART 1.

Temperature chart.

dent, upon his admission to the Rome Hospital, he was unable to take any nourishment by mouth and his jaws were so tightly clenched that the teeth of his lower jaw were cutting into the gum of the upper, and it was necessary to extract six of them. Subsequent to this he was able to take liquid nourishment by mouth for a day, but on the following day it was necessary to resort to rectal feeding. There was some slight twitching of the extremities.

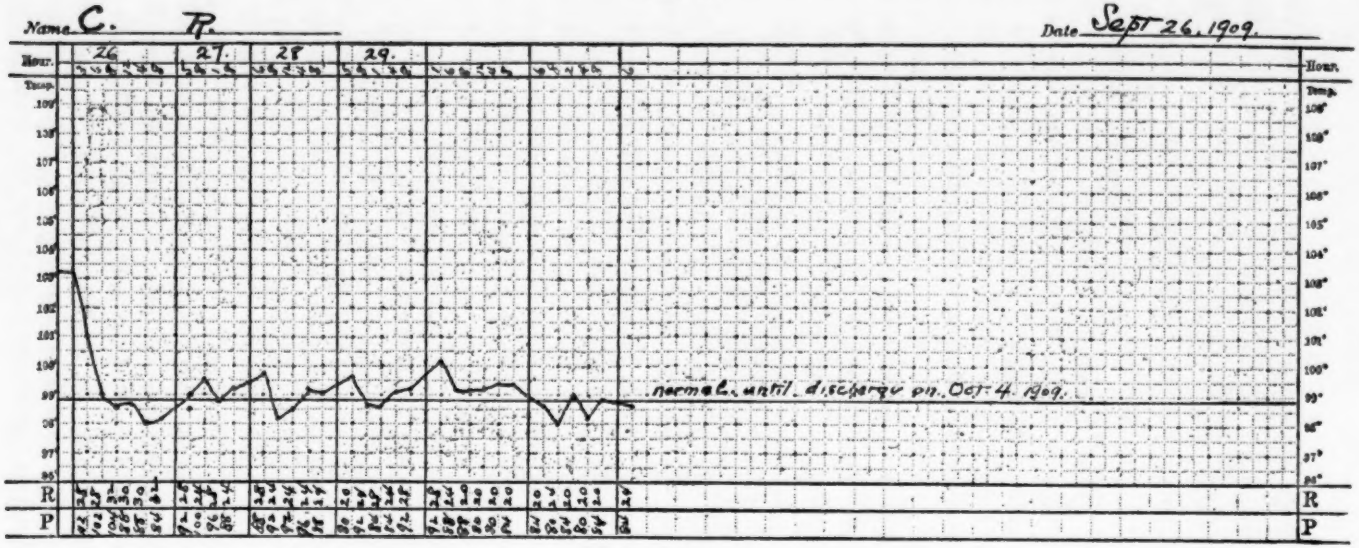
Physical examination at this time showed complete right-sided prosopoplegia determined by marked drooping of the corner of the mouth, obliteration of the nasolabial fold, and inability to close the eye or make a grimace on the right side of his face. There was marked spasm of the muscles of mastication of both sides, the jaws in consequence were tightly clenched, and it was impossible for the patient to open his mouth. When the patient wished to talk he placed his fingers between his lips to hold them apart. Any attempt to test the reactions of the right facial muscles resulted in such an increase of the painful spasm that this was given up after a very brief and unsatisfactory trial. There were occasional slight twitchings noted in the muscles of the extremities. The remainder of the physical examination revealed normal organs. The temperature (axillary) ranged from 98.6° in the morning to 100.5° in the afternoon, with a corresponding range in pulse and respiration from 64 to 92 and 16 to 20, respectively. The patient was given 1500 units of tetanus antitoxin subcutaneously.

For the next five days the above conditions persisted, and in addition exceedingly painful and distressing spasms of the pharyngeal muscles appeared, which were aggravated by any attempt at swallowing. For two days there were also severe respiratory spasms, and at times a restless delirium with a temperature reaching 103°, pulse of 100 to 124, and respirations 20 to 32.

On the tenth day of the disease a slight conjunctivitis and keratitis developed in the right eye, which promptly subsided under appropriate treatment.

On the twelfth day of the disease the spasms of the muscles of mastication began to decrease; the patient was able to take nourishment by mouth and appeared to be improving. The temperature range was a little lower.

CHART II.



Temperature chart.

On the fifteenth day the patient developed severe paroxysms of coughing, and at the same time complained of a pain in his right shoulder and the right side of his chest which was increased by coughing or taking a deep breath. The attacks of coughing lasted for from 15 to 20 minutes, being induced especially by any endeavor to take food, and in consequence rectal feedings were again instituted. These severe paroxysms continued at intervals until the twentieth day, when they began to decrease in severity and soon disappeared. On the seventeenth day he had a chill lasting a few moments and followed by a rise in temperature to 101.1°, and this was repeated on the eighteenth day, this time being more severe, and followed by a rise of temperature to 104.2°. On the following day the temperature fell rapidly to normal and remained there. Physical examination during the above period elicited the signs of dry pleurisy on the right side, consequently it seems reasonable to assume that the symptoms were entirely distinct from the symptoms of tetanus which had preceded them.

At the time of the fall of temperature to normal, the trismus had so far relaxed that it was deemed safe to take the patient's temperature by mouth. From this time on the convalescence was rapid and the patient was discharged on the twenty-eighth day after his injury, with a very slight prosopoplegia remaining and with the wound healed by granulation after a mild suppurative course.

From the sixth until the fourteenth day of his disease inclusive, the patient received 65,500 units of tetanus antitoxin, injected subcutaneously in ten doses ranging from 1500 to 11,500 units at a dose.

A stab culture taken from the wound was examined bacteriologically by Dr. W. S. Nelson, of Utica, New York, and a preliminary report of bacilli closely resembling tetanus bacilli but without spores was made. Owing to the sudden illness and death of Dr. Nelson, further investigations which were under way were never completed.

REVIEW OF CASES REPORTED IN MEDICAL LITERATURE.

Willard[4] in 1895 was able to collect 74 published cases in the literature, his own case making 75. Ross[5] in 1906 presented an analysis of 81 cases in the literature up to that time,

and since that date I have found 12 cases, the one here reported making 13, thus bringing the total to date to 94 cases.

In 84 per cent. of cases the first sign of the disease has been trismus, either alone or accompanied by paralysis of one or more of the cranial nerves. The paralysis, however, usually follows the trismus. In 14 cases, including the one here reported, prosopoplegia has preceded the appearance of the trismus. Ross [5] asserts that the appearance of this symptom before the trismus determines an almost invariably fatal termination, but this observation does not appear to hold good in the series to date, as of the 14 cases but 9 have died, thus making a mortality of 64.2 per cent., as contrasted with a mortality of 53.2 per cent. for cephalic tetanus as a whole. The 13 previous cases in which paralysis has preceded the trismus have been reported in detail by Stolz.[7]

Neumann [6] claims that the facial nerve is involved most frequently, then the oculomotor, abducens, trochlear, and hypoglossal in the order named, but at the same time states that the cases are too few in number to make any dogmatic rule. This observation has proven true in the series to date.

Prosopoplegia is by far the most common form of paralysis and appears on the side of the lesion. Cases of crossed paralysis have been reported but are open to doubt as to the site of infection.

Bilateral prosopoplegia has been reported in seven cases. In all but one case, that of Roberts,[21] the wound has been across the median line of the head, usually across the bridge of the nose. Not all median line wounds, however, have given rise to bilateral prosopoplegia (Nankivell,[22] Wagner,[24] Oliva,[23] and Nerlich [16]).

Paralysis of one or more of the muscles of the eye has been described, and in these cases the wound has involved the orbit. The paralysis has varied from complete ophthalmoplegia to paralysis of one nerve only. Ptosis has been noted in eight cases, strabismus in four, nystagmus in one. Fixed dilatation of the pupil has been described.

Paralysis of half the tongue denoting involvement of the

hypoglossal nerve has been noted in two cases as the trismus was disappearing.

The site of the wound has been on the head or face in all but two cases. Duvergey [8] reports a case in which the site of infection was supposedly under the finger-nail, thus leaving room for doubt as to the site of the lesion, and Zack [9] reports a case of cephalic tetanus following a wound of the foot.

The prognosis depends upon two factors: first, the length of the incubation period; as a general rule it may be said that the shorter the incubation period, the more dangerous the disease; and second, upon the localization of the tetanic spasms. In those cases in which the spasms remain localized in the muscles of mastication and deglutition, the prognosis is good, regardless of the length of the incubation period. If respiratory spasms supervene, the prognosis is more grave, as death may and often does occur during a spasm. If the spasms become generalized, the prognosis is almost invariably fatal.

With regard to the etiology of the condition, a sufficient number of cases have been reported in which tetanus bacilli have been obtained by culture from the wound to make it practically certain that the disease is due to this infection.

Regarding the pathology of the paralyses, however, many theories have been advanced. Rose [10] claims that the paralysis is caused by a local inflammation of the seventh nerve, causing a swelling of its trunk and a consequent constriction at its exit from the stylomastoid foramen. This view is not supported by autopsy findings, as such conditions have never been observed and in all cases reported the nerve-trunk has been found normal on microscopical examination.

Serems [11] has suggested that the paralysis is reflex from involvement of the fifth nerve.

Brünner [12] believes that the paralysis is caused by a selective toxin which is paralytic in its action and affects the end organs of the nerve-fibre. He notes the fact that Fraenkel and Kitasato have been able to produce the facial and ocular palsies in rabbits by the injection of the crude toxin into the facial muscles, but at the same time there has been a reaction

of degeneration present in the affected muscles, while in cephalic tetanus the prosopoplegia is of the character of Bell's palsy and presents no reaction of degeneration. Klemm [13] also advocates the above theory.

Binet and Trénel [14] state that contraction and paralysis of muscle due to nerve impulse are two phenomena of the same order corresponding to two different states of the nerve-cell. The first phase, causing contraction, is excitation; the second, causing paralysis, is complete annihilation. Consequently the effect on the nerve-cell is governed by the amount of toxin transmitted along the nerve-fibre to the nucleus. They argue that the seventh nerve is usually first involved, or if the lesion be in the orbit, the third, and there is sufficient strength in the toxin to cause annihilation of the cells of the nucleus and consequent paralysis. By the time the toxin reaches the motor nucleus of the fifth nerve, however, it is so attenuated that excitation of the cells is caused and spasm results.

Gosselin [15] asserts that there is no true paralysis of the cranial nerves, but the muscles of the opposite side are in excessive contraction, and consequently there appears to be a paralysis of one side. This view is sufficiently refuted by the occurrence of bilateral prosopoplegia.

Nerlich [16] was the first to suggest that the toxin acts on the motor cells in the central nuclei, basing this assumption on the fact that he noted bubble-shaped lesions in the motor cells situated in the nucleus of the twelfth nerve on the side corresponding to the lesion and in both seventh nerve nuclei. The wound in his case was across the bridge of the nose, but the patient exhibited left-sided prosopoplegia only.

Berkhardt [17] reports lesions in the brain stem at the level of the nucleus of the seventh nerve.

Bourgeois [18] states that he has found pigmentation in the nucleus of the twelfth nerve.

The method by which the toxin reaches the central nervous system is by passage along the nerve-fibre from the point of injury as shown by Marie and Morax.[19] The toxin presumably travels by lymphatic paths.

Von Orzechowski [20] reports a fatal case in which he found the nuclei of the third, fourth, fifth, and sixth nerves normal. In the nucleus of the seventh nerve corresponding to the side of the lesion there was a group of cells in the ventromedian portion which showed chromatolysis. There was also vacuolization of cells which corresponded to the description of Nerlich. He quotes Goldscheider and Flatau, Goebel, Matthes, Von Halbau, Sjovall, and Kron as having also found the same lesions. He also notes the same vacuolization of cells occurring lower down in the cord, and the history of his case shows that the patient suffered a wound not only on his face but also on the chest, and suffered from generalized spasm as well as from prosopoplegia. This would tend to show that the lesion in the central nucleus is localized in an area corresponding to the site of the lesion of the nerve, whatever that may be.

From the weight of evidence at the present time, it seems fair to assume that the paralysis is due to the action of the toxin upon the nucleus of the nerve which supplies the muscles in the neighborhood of the injury. The toxin is carried to the nerve through the lymphatics, and thence transmitted along the nerve-trunk by the lymphatics to the nucleus. If this point be granted, may it not be true that this condition may be present in any portion of the body? Prosopoplegia would be noted particularly by contrast to the spasm of the opposite side of the face, whereas, on the other hand, paralysis of individual muscles or muscle groups in other parts of the body would easily escape detection by being overshadowed by the general spasm.

In the cases of cephalic tetanus, many which have resulted fatally have shown generalized tetanus and have also shown wounds outside of the facial area, as did Von Orzechowski's. When this has not been the case the fatal issue has often occurred in a respiratory spasm. The early symptom of general tetanus is trismus as the common name of the disease, lockjaw, implies. This in general tetanus is followed by pharyngeal and respiratory spasm, stiffness of the neck, and

gradual passage of the area of spasm down the body, thus denoting a passage of the toxin downward along nerve-trunks. At the same time it is now fairly well established that the toxin gains access to the central nervous system through lymphatic paths.

Turning now for a moment to the consideration of another grave condition which travels by lymphatic paths, carcinoma, we find that there has long been recognized a portion of the body, sparsely supplied with lymphatics, in which carcinoma is quite benign. This area is bounded below and behind by a line drawn from the lower border of the ala of the nose backward to the inferior border of the lobule of the ear, and thence vertically upward through the external auditory meatus to the median line, where it meets a corresponding line of the opposite side. Carcinoma occurring in this area rarely gives rise to metastases or cachexia, and aside from the local lesion is comparatively benign. It seems fair to assume then, reasoning by analogy, that tetanus occurring in this same area, without a wound of any other portion of the body, will, because of the limited absorption of the toxin by the lymphatics, be of a benign form and present only the early symptoms of the disease, namely, trismus, pharyngeal and respiratory spasm, while exactly the same infection, occurring in other parts of the body, owing to the plentiful lymphatic drainage, will be absorbed more rapidly and in greater amount, and will, in consequence, give rise to generalized spasm.

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TREATMENT OF HEART WOUNDS.*

REPORT OF SUCCESSFUL CARDIORRHAPHY AND TABULATION OF CASES.

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On July 18, 1911, at 7.10 P. M., a young man, twenty-four years old, a native of Sicily, was brought to the New York Hospital in the ambulance about 30 minutes after he had attempted to commit suicide by stabbing himself with a knife over the heart. He was admitted to the service of Dr. A. B. Johnson, to whom I am indebted for the privilege of treating the case.

I was at the hospital when the patient was brought in and saw him immediately. He was a small, thin man in a condition of profound shock. He was lethargic, and no facts concerning the injury could be elicited from him. The pulse was imperceptible in the radial arteries; the heart sounds were audible but distant and muffled. Percussion indicated an increase in the area of cardiac dulness, though we did not delay to map it out accurately. There was a wound about one-half inch in length in the fourth intercostal space close to the upper border of the fifth rib and just mesial to the nipple. A probe inserted a short distance showed that the direction of the wound was somewhat upward and inward. There was very little external hemorrhage. It seemed reasonably certain that there was a wound of the heart and that death was imminent unless immediate operation could be successfully performed. As the operating room had been prepared for another operation, it was possible to put the patient on the table without delay and to begin the operation less than an hour after the accident.

The wound was protected with gauze and the surrounding skin thoroughly cleansed, after which the wound and the operative field were painted with 3.5 per cent. tincture of iodine. As the patient seemed to experience some pain when the iodine came in contact with the wound, light ether anæsthesia was begun at

* Read before the Surgical Section of the New York Academy of Medicine, January 5, 1912.

once. The wound was extended along the upper border of the fifth rib toward the sternum, crossing and dividing the cartilage near its insertion. The stab wound entered the pleura, and in exposing the pericardium the pleura was injured further. The pericardium was incised in the direction of the wound, allowing the escape of considerable blood, and the index-finger was inserted into the pericardial sac. It failed to locate the wound in the heart, but palpation of the inner surface of the pericardium revealed an opening in it, corresponding in position to the original surface wound. The exposure of the heart was rapidly improved by making a "trap door." For this the incision was carried upward along the sternum and thence outward along the lower margin of the third costal cartilage. The cartilages of the third and fourth ribs were divided close to the sternum, the third being readily exposed by retracting the soft parts upward. The two cartilages were then carefully lifted, separated from the pleura, and fractured at the costochondral junction, forming a flap with skin and muscles attached; resection of the fifth cartilage was contemplated but was delayed and did not prove necessary. The internal mammary was clamped and ligated above and below when exposed. The opening in the pericardium was enlarged by an incision upward near the sternum, making a triangular flap. Hemorrhage was very free; the operative field was a lake of blood in which were churned bubbles of air.

Palpation revealed the rent in the heart, which admitted the tip of the index-finger. As the finger was withdrawn from the hole a well-vaselined silk suture was passed from above downward on a fine curved intestinal needle; this was tied and left long. By gentle traction on this suture the heart was readily lifted and rotated, so that the wound was rendered visible and readily accessible. The wound involved the left margin of the heart somewhat posteriorly; it was about one-half inch in length, transverse on the long axis of the heart, and approximately one and one-half inches above the apex. Though the wound was partially closed by the first suture, blood gushed out whenever the finger was momentarily lifted to pass a stitch. Five stitches were inserted and tied before the bleeding was completely controlled. All visible blood was then removed and the pericardium closed with interrupted catgut stitches. There was considerable tension between the edges of the pericardial wound, which caused

some gaping between the stitches in the lower mesial part. The flap was replaced and chromic stitches used to repair muscles and fascia. The skin was closed with silk. In the outer angles of the wound rubber tissue drains were inserted through the skin. At the lower mesial angle of the wound a rubber tissue drain was inserted down to but not into the pericardium. After the wound in the heart had been closed an infusion of 16 ounces of salt solution was slowly given. The operation took about thirty minutes.

Post-operative Course.—For 24 hours after the operation the patient was restless, irritable, and thirsty. He was given morphine freely and saline continuously by rectum (Murphy drip). During this time the highest pulse-rate was 128; respirations were 24–28; temperature 102°. When the dressing was changed at the end of 16 hours and the drains removed, a very large quantity of clear serum exuded from the drainage openings. A rubber tissue drain was therefore reinserted at the lower inner angle. A similar discharge occurred again at the next dressing 30 hours after the operation. At that time the pulse had risen to 132; the temperature remained 102°. White blood-cells were 19,000, polymorphonuclears 83 per cent. The serous discharge continued to be free until 48 hours after the operation, when the single remaining drain was removed from the lower and inner angle of the wound. At this time the pulse was 112, temperature 101°, respirations 24. The patient was refractory and refused to eat, because, he said, he wanted to die; he was also very irritable and restless. Twice he sat up in bed. Morphine was given and he became quiet. Rectal alimentation was begun.

July 22 (fourth day): condition good, pulse 104–124, temperature 102°. White blood-cells 17,500, polymorphonuclears 84 per cent. Patient still refused nourishment. Wound dry and clean.

July 23: condition about the same.

July 24 (sixth day): large amount of serum exuded from the wound, after which the pulse became very rapid.

July 25 (seventh day): constant free discharge of clear serous fluid requiring frequent dressings. The patient still refused nourishment, was extremely weak, and appeared to be in serious condition.

Blood-pressure taken twice a day from the third to the eighth days was always between 90 and 110.

July 26 (eighth day): the patient was persuaded to eat by threats of passing the stomach tube; nutrient enemata were discontinued. Wound dry and clean, temperature normal, pulse 90, white blood-cells 10,000, polymorphonuclears 74 per cent. From this time the convalescence was uneventful. The patient was allowed up on the eighteenth day and discharged from the hospital on the twenty-fifth day.

The man was seen on December 12, four and a half months after the operation. His general condition was excellent. The heart-beats were visible in the fourth interspace three and a half inches to the left of the mid-line; there was a very slight systolic thrill at the apex. Prominences at the sternal attachments of the third and fourth cartilages, where these had been cut, were visible and palpable, also slight depressions where they had been fractured at the pedicle of the flap. Otherwise, examination of the chest revealed nothing abnormal.

The rationality of immediate surgical treatment for wounds of the heart has been thoroughly established by fifteen years of relatively good and constantly improving results. Even in suspected wounds of the heart, when the diagnosis is probable but not positive, exploratory operation is an approved procedure, as has been emphasized by E. Hesse, Foederl, and others, for the following reasons: First, there is no typical clinical picture whereby a wounded heart can always be diagnosed, especially in the first few hours after injury. The classical syndrome, "heart tamponade," due to intrapericardial pressure, is more often absent than present (Borchardt); physical signs in the cardiac region, such as abnormal sounds and increased dulness, are frequently inconclusive; the position and direction of the surface wound are not always convincing; while the suggestive symptoms of internal hemorrhage, hæmothorax or hæmopneumothorax may originate entirely in thoracic lesions other than a heart injury. Thus, in the 21 cases which were the basis of E. Hesse's report, heart tamponade was absent in 13; in only 11 of the 21 cases was

FIG. 1.

Photograph taken on the eighteenth day after operation (author's case).

the diagnosis certain, whereas in 4 it was probable and in 6 doubtful on account of the absence of all reliable signs. Second, it has been shown by statistics that the prognosis, by reason of hemorrhage and shock, becomes progressively worse as the interval between the trauma and the operation lengthens. Therefore, although delay in some cases will render the diagnosis certain, postponement of operation until dangerous symptoms make their appearance is not to be recommended. Third, the immediate results of non-operative treatment are very poor as compared with those obtained by operation (E. Hesse). Moreover, although some heart wounds heal without surgical intervention, there is always danger of secondary hemorrhage from an unsutured wound, and the spontaneously healed heart wound, even a non-perforating wound, leaves a weak scar which may rupture or become the site of an aneurism (Rehn). Loison, as early as 1899, collected nine such cases.

The technic of operation for wounds of the heart may be dismissed briefly, since a number of recent articles enter exhaustively into discussion of the details. There are only a few features on which it is necessary to dwell. These are the use of differential pressure, the method of exposing the heart, and the question of pericardial and pleural drainage.

Technic of Operation.—Careful preparation of the operative field is essential, since many cases which have survived shock and hemorrhage have died later as a result of infection. Experience indicates that anæsthesia should consist in the sparing administration of a general anæsthetic, preferably ether, when the patient shows signs of sensibility. The indications for differential pressure are so striking as to induce its employment. Since the recent development of the Meltzer method, it has become possible for every hospital to be provided with facilities for the use of differential pressure, even if elaborate apparatus, such as those of Janeway and Elsberg, are not available. Therefore, the applicability of differential pressure in operations for wounds of the heart will doubtless

be thoroughly tested in the immediate future, consequently, this detail deserves careful consideration.

A majority of the cases of heart wounds are complicated by opening of the pleura (Borchardt); Sauerbruch puts the figure at 80 per cent. Even if not opened by the original wound, experience shows that the pleura is usually torn during the course of the operation. Pneumothorax with collapse of the lung is therefore likely to occur in every case. But the immediate dangers due to pneumothorax can be eliminated and the late dangers minimized by the use of differential pressure. Therefore, differential pressure permits a disregard of the pleura, and, consequently, expedites the operation by allowing a free transpleural exposure; moreover, it greatly diminishes the tendency to post-operative infection, by allowing dilatation of the lung and consequent absence of pneumothorax following the operation (Sauerbruch). Other less important advantages of differential pressure are that it increases oxygenation of the blood, improves the heart action, renders the technic of the heart suture easier in that it lifts the heart and renders it more accessible, at the same time removing the annoying respiratory movements, and, finally, assists in the discovery of a wound of the lung so that it may be sutured (Sauerbruch and Haecker).

There are some considerations which indicate great care in the amount of pressure used during the first stages of the operation. Sauerbruch and Haecker found in animal experiments that at first a pneumothorax leads to a diminution of heart activity and lessens the bleeding from the heart. On the basis of these findings Matas discourages the use of differential pressure until the heart has been sutured, because he considers that a collapsed lung may be an advantage by diminishing the bleeding from the heart wound. But Sauerbruch and Haecker state that in their experiments continuation of the collapsed lung led to such depression of the heart as to render it necessary to dilate the lung in order to save the animal, and Sauerbruch believes that low pressure, such as 3

mm.Hg, does not increase the bleeding. Therefore, although Matas's warning should be borne in mind, it seems probable that differential pressure, in view of its marked indications, may be used throughout with advantage, danger from increased hemorrhage being averted by a rapid exposure and rapid control of hemorrhage, pressure being reduced to a minimum until bleeding has been controlled. Possibly insufflation of oxygen will prove an advantage in this connection, since it can be used under much lower pressure than is necessary to give the same effects with air (Volhard, Tiegel). In operations for heart wounds, differential pressure has been employed in one case by Friedrich and in four cases reported by Ranzi. As a result of his experiences, Ranzi expresses himself very positively in favor of its use.

The question of exposure of the heart is greatly simplified if it is recognized that an extrapleural cardiorrhaphy is rarely possible, and if dependence is placed upon differential pressure for controlling the dangers of pneumothorax. The numerous methods which have been suggested for exposing the heart will not be enumerated here. The principles of exposure by which almost all indications can be met most satisfactorily are the intercostal incision, the osteoplastic flap, and the extrapleural exploratory pericardiotomy.

The intercostal incision, as Wilms states, affords free exposure of the heart, can be applied much more quickly than a flap operation, and causes less hemorrhage, while the resulting pneumothorax cannot be urged against the method since it is rarely possible to avoid its occurrence by other procedures. It should be elected when differential pressure is used, when pneumothorax is already present, or when the condition of the patient makes speed of primary importance. A long intercostal incision placed in the fourth space gives the best exposure, although other spaces may be used. The proper application of this incision necessitates opening the pleura freely; forcible retraction then gives considerable exposure. As in all methods, the internal mammary must be ligated

above and below when exposed. After opening the pericardium in the line of incision, if more space is desired, it may be obtained by cutting away part of the sternum and by section near the sternum of adjacent rib cartilages with or without incision of the soft parts upward or downward.

Although the preservation of the pleura, as Rehn points out, is a distinct advantage, it should be aimed at only in selected cases, since the effort delays the operation and usually fails. The circumstances which warrant an effort toward an extrapleural operation are: differential pressure not available, pneumothorax not present, no wound of the pleura such as would render the effort useless, adequate assistance, and relatively good condition of the patient, for when the condition is grave it is important to adopt the simplest and quickest method and to lose no time in attempts at elaborate extrapleural procedures.

Certain flap methods afford good exposure and offer the best prospects of preserving the pleura intact, when such an effort appears indicated. A flap with lateral base has proved the most satisfactory both in operations and experimentally on the cadaver. A flap, as planned by Kocher, gives admirable exposure. An incision of about 10 cm. is made from the middle of the sternum along the sixth left costal cartilage, which is carefully resected after separating the perichondrium; the pleura is exposed and stripped outward; an extrapleural exploratory pericardiotomy is then possible. From the inner end of this incision, a vertical incision is carried upward on the sternum as far as is indicated, even to the third rib; a third incision of 8 cm. is carried horizontally outward. A flap of the fifth, fourth, and, if necessary, third cartilages is lifted, separating and stripping the pleura outward. The cartilages are broken at the costochondral junction. In the event of a small wound being made in the pleura, an effort should be made to limit the entrance of air into the cavity by protecting the hole with gauze; a large wound must be disregarded. This method not only gives a good exposure, but

permits satisfactory primary or secondary drainage in a dependent part of the pericardium and the part uncovered by pleura. Yet for some cases it would carry the exposure unnecessarily low. Therefore, in high wounds a simpler and more suitable procedure may be used by omitting the resection of the sixth cartilage and forming a flap appropriately placed with pedicle outward of two or three rib cartilages, especially the fourth, fifth, and third. Additional space in the direction needed may be obtained by cutting away part of the sternum and section or resection of adjacent cartilages. The pleura should be carefully separated and stripped outward.

In certain doubtful cases the primary incision may be designed for exploration. The original wound, if situated in the precordial region, may then be extended and deepened layer by layer, the edges of the original wound being excised (Peck). If it appears indicated, the incision may be utilized for carrying out one of the methods of exposure already mentioned or for an appropriate atypical exposure. If the wound is not in the precordial region, in the absence of differential pressure, an extrapleural exploratory pericardiotomy may be used advantageously. For this, resection of the sixth cartilage, as in the first step of Kocher's procedure, is to be recommended. In the rare condition of a wound of the right side with right pneumothorax, the exposure of the heart must be planned to avoid opening the left pleura, especially when differential pressure is not used. Partial resection of the sternum is then indicated. Konig suggests as the best procedure that of Marion with the modifications of Wehr and Lorenz.

After exposure of the heart, if any difficulty is encountered in locating the wound, the index and middle fingers of the left hand may be inserted posterior to the heart, the thumb being placed on its anterior surface, and it may then be lifted, turned, or drawn downward for inspection (Rehn, quoted by Sauerbruch). But if hemorrhage is excessive, the method suggested by Sauerbruch and Haecker may be advantageously

used: the left hand is inserted so that the right auricle with its entering vessels lies between the third and fourth fingers, while the thumb and index-finger grasp the lower portion of the heart and luxate it upward; this, they say, serves to bend the vessels and control bleeding, while at the same time the heart wound is rendered accessible. Rehn suggests controlling hemorrhage by compressing the inferior and even the superior vena cava with the fingers of the left hand.

For suturing the heart, both chromicized catgut and silk have been used. Yet the interrupted silk suture well vaselined has much to commend it, in that it offers a finer material, which causes the minimum of trauma, is well tolerated, allows the knots to be tied more securely, and is not loosened by subsequent softening of the suture material at the knots. In a case of wound of the left ventricle reported by Schoenborn catgut sutures were used and were found at autopsy a few hours later so loose that they probably would have given way.

After the controlling stitch has been placed, it should not be difficult in most cases to insert the remaining stitches. In our case this was done quite easily by having the assistant draw on the first stitch with one hand and control the bleeding by pressure with a finger of the other hand; for each subsequent stitch this finger was momentarily lifted. It was found impossible to differentiate between systole and diastole in tying the sutures, and case reports show this to be a common experience. The suture should not penetrate the heart wall, yet reports indicate that in thin-walled portions of the heart it is impossible to determine accurately the depth of a suture. Occasionally, as in cases reported by Neumann and E. Hesse, cardiorrhaphy is unsuccessful on account of friability of the heart muscle and persistent cutting through of the sutures. In such an event the latter recommends cardopericardoplasty.

For cessation of the heart action during operation, gentle massage is indicated. Injections of salt solution into the cavity of the left ventricle (Gütig) and camphor (F. Hesse) or adrenalin (Leichner) into the wall of the ventricle have been tried but without very encouraging results.

After the heart has been repaired, a saline infusion should be begun and the lung should be inspected when an injury seems probable, because a neglected pulmonary injury may lead to a fatal outcome. Death in one of Heinrichsen's cases was due to a simultaneous injury of the lung which had been overlooked. The importance of this step is further emphasized by statistics, which indicate that the lung is injured in a large proportion of cases, 13 per cent. of stab wounds according to Loison.

The closure of the pericardial sac should be made with interrupted catgut sutures, because tension between the edges of the wound may occur not only at the time of operation but later as the result of distention of the sac with serum, consequently distribution of the strain among a number of stitches renders the suture more secure.

The question of drainage is important, since a large proportion of cases are lost as a result of the infection of the pericardial or pleural cavities. It is fair to assume that faulty judgment in the matter of drainage is often responsible.

There are strong arguments for and against pericardial drainage which may be briefly considered: it is probable that a considerable post-operative exudation of serum, due to traumatic pericarditis, is not infrequent after operations on the heart, as is evidenced by the cases of Magenau and Torre, which were not drained, and the case here reported, in which no drain entered the pericardial sac. Should this serum be confined within the pericardial sac, the heart action may be impaired, as in the cases of Proust and Magenau, in which the heart action improved after liberating the fluid; should it accumulate in the soft parts outside of the pericardial sac, it would favor extensive suppuration. Hence an exit for this fluid would prove an advantage. If infection has been introduced by the original wound or during the operation, drainage will obviously be an advantage. If care be taken in the dressings, subsequent infection should not occur, since the discharge, although free, persists as a rule for only a few days. While dangerous accumulation of serum may be removed by

aspiration, the procedure is not without danger, and the indications are not clear until serious symptoms have developed.

On the other hand, the irritation of a drain projecting into the sac might reasonably be supposed to favor excessive exudation, as occurred in the cases of Schoenmaker, Proust, Neugebauer and Renner, and the formation of adhesions, which militate against the best functional activity. That serious results may be due to adhesions is shown by Walther's case of stab wound of the right ventricle which was sutured. Three years and eight months after operation death occurred as the result of cardiac insufficiency. At autopsy extensive cardiopericardial adhesions were found; the cicatrix appeared as a wide translucent area, and at this site the heart wall was very thin, though there was no aneurism.

It is evident that drainage in each case must be decided by the individual indications. In some cases in which there is short exposure and little trauma, closure without drainage should be carried out; on the other hand, when the nature of the wound and the operation render infection probable, the drain should penetrate slightly into the sac. But in doubtful cases, on the basis of the above reasoning, it appears safest to treat the detail of pericardial drainage as follows: First, to leave unsutured a small portion of the lowermost, or in an intercostal incision the innermost, part of the pericardial wound, so that in the event of a large accumulation of serum the fluid may exude through the opening, and, second, to provide a surface exit for the serum by inserting a drain down to but not into the pericardial sac. This method proved fairly satisfactory in our own case, although the drain was too small and not sufficiently loose to allow continuous drainage. A cigarette or rubber tissue drain should prove most satisfactory. As suggested by case reports, any form of drain, such as gauze, which is likely to obstruct and not drain should be avoided. On the other hand, a rubber tube while best for drainage might communicate with the pleural cavity when this has been opened, especially in an intercostal incision, and cause a pneumothorax.

Drainage of the pleural cavity has been urged, notably by F. Hesse, on the theory that infection in the pleural cavity that has been opened is peculiarly prone to occur, not only as the result of the wound or ordinary operative infection, but as the result of air infection, since air is sucked in and expelled with every respiratory movement. Moreover, the pleural resistance is diminished by prolonged exposure to the air, operative traumatism, post-operative pneumothorax, and the persistence of blood or the accumulation of exudate in the cavity. Further, the pleura does not react to the same degree as the peritoneum, in localizing inflammatory processes through adhesions.

Against drainage may be urged the resulting pneumothorax, which can be entirely eliminated by differential pressure when drainage is not used; and the danger of infection from without, as the result of the drainage. Infection in a drained case is difficult to prevent because the discharge in such cases is usually copious and prolonged (cf. cases of F. Hesse, 1909, Einar Key, and others).

Statistical analyses of the reported cases do not aid as much as might be expected in deciding the question of drainage, since conclusions based on the statistics are not convincing by reason of the numerous modifying factors of each case, such as associated pericardial and lung lesions. Further, accurate statistics are impossible, because many unsuccessful cardiorrhaphies remain unpublished; moreover, complete details of published cases are often not given. Yet, recent writers have been somewhat influenced by statistical studies. Thus E. Hesse favors closure of pleura and pericardium on the basis of his own experiences and the following statistical considerations:

Pericardium and pleura were closed in 30 cases, 21 (70 per cent.) recovered.

Pericardium and pleura drained in 43 cases, 25 (58 per cent.) recovered.

Pericardium closed, pleura drained in 25 cases, 10 (40 per cent.) recovered.

Pericardium closed, no statement as to pleura, in 15 cases, 10 recovered.

Pericardium drained, no statement as to pleura, in 8 cases, 4 recovered.

Hesse's personal cases in which the patient survived operation: both closed 6 cases, 5 cures; both drained 6 cases, 1 cure; pericardium closed, pleura drained 3 cases, 0 cures.

On the other hand, although the statistical compilation of Rehn (1907) does not show the advantage of closure of the pleura, Rehn proclaimed himself against pleural drainage.

It is my opinion that the pleural cavity should not be drained as a "prophylactic" step against possible infection unless there are very strong reasons for suspecting infection. In general, the accumulated blood should be removed entirely from the pleural cavity by aspiration and gentle sponging, avoiding, as far as possible, injury to the pleura. The pleural wounds should be carefully closed with distention of the lung if differential pressure is used. Evidences of pleural infection should be watched for, and, if necessary, drainage be established later, as has been done in a number of cases. In exceptional cases where exposure has been prolonged and when from the nature of the wound and its administration infection appears probable, the thorax should be drained, especially if differential pressure has not been used. The drainage should be made posteriorly just as in empyema; as emphasized by F. Hesse, anterior drainage can be of little use.

The number of reported cases of heart suture has increased rapidly in the last few years. E. Hesse (Russia) reports twenty-one cases which were treated by cardiorrhaphy in the Obuchow Hospital in St. Petersburg, four more being added during the preparation of the paper. F. Hesse (Germany) contributes three more cases operated upon by him. He and others likewise report quite a number of old cases not previously published.

E. Hesse (1911) was able to collect 219 cases with 116 deaths and 103 recoveries. He points out that this ratio

gives a false impression of the percentage of cures, because numerous failures are doubtless not reported. He calls attention to the relatively small number of cases in the United States and England and the large number in Italy and Russia.

An effort has been made, with the co-operation of Dr. F. Robbins, to tabulate 77 cases of heart suture reported in 1909, 1910 and 1911, including earlier cases not previously reported, in order to supplement the table of 159 cases published by Peck in 1909, bringing the total to 236.

CONCLUSIONS.

1. The treatment of heart wounds should be surgical. Even in suspected wounds of the heart, when the diagnosis is probable but not positive, exploration should be performed.

2. Careful preparation of the field of operation is essential, since many fatal results have been due to sepsis.

3. Light general anæsthesia, preferably ether, should be given when there are signs of sensibility.

4. It is important to recognize that in a large proportion of heart wounds the pleura is opened and that an extrapleural cardiorrhaphy is rarely possible.

5. Differential pressure offers marked advantages chiefly by eliminating the immediate and minimizing the late dangers due to pneumothorax. Its use expedites the operation by allowing a free transpleural exposure. But prior to the control of bleeding from the heart wound positive pressure should be used with great care because it may increase hemorrhage.

6. (*a*) A transpleural exposure with long intercostal incision is ordinarily the best because it affords free exposure of the heart, can be applied much more quickly than other procedures, and causes less hemorrhage. This exposure should be employed when differential pressure is used, when speed is important, or when pneumothorax is present.

(*b*) An effort to do an extrapleural operation is warranted in exceptional cases. The indications are: differential pressure not available, pneumothorax not present, no injury

to the pleura such as would render the effort useless, adequate assistance, and relatively good condition of the patient. Under these conditions, a flap with pedicle outward is favorable.

(*c*) In some cases in which the diagnosis is in doubt, extrapleural exploratory pericardiotomy may be performed by resection of the sixth costal cartilage as in the primary incision of Kocher's flap operation.

(*d*) Atypical procedures are at times indicated.

7. Fine vaselined silk on a curved intestinal needle is the best material for heart suture.

8. The pericardium should be closed with interrupted catgut sutures.

9. Pericardial drainage may be dispensed with in some cases when there is short exposure and little trauma. A drain should enter the pericardium to a slight extent when the nature of the wound renders infection probable. But in doubtful cases it is best to insert a drain down to but not into the pericardial wound, a small part of which should be left unsutured. In this way an exit is provided for the large accumulation of serum which is likely to occur as the result of traumatic pericarditis, and no irritation of the pericardium is caused by the presence of a drain.

10. Pleural drainage is a prophylactic step which is often unnecessary and likely to be harmful. Unless there is a strong probability of infection, it is better to delay drainage until infection has occurred and then to do secondary thoracotomy.

TABULATION OF CASES OF HEART SUTURE SUPPLEMENTING PECK'S TABLE, 1909.

Borzymowski, 2 cases (*Centralblatt. f. Chirurgie,* No. 30, 1910, p. 1007): Method recommended and presumably used: skin incision down middle of sternum from third cartilage and outward along fifth. Resection of 3 cm. of third, fourth, fifth cartilages and adjacent half of sternum. Pleura is separated unopened. Heart wound sutured and stitched around with pericardium. Drainage of pericardium. One recovered, one died. Original report not accessible. (*Przegl. Chir. i ginek,* Warsaw, 1909, i, p. 50.) These are Borzymowski's fourth and fifth cases.

Boljarski (*Russki Vratsch*, No. 5, 1911; *Centralblatt. f. Chir.*, No. 22, 1911, p. 787): Stab wound, 2 cm. long, between fifth and sixth left ribs, external to nipple line. Male, age 27 years. Hæmopericardium. Wound of left ventricle 5 cm. from apex. Enlargement of skin wound along ribs to 10 cm. Resection of fourth and fifth costal cartilages. Heart wound closed with three silk sutures. Pericardium and pleura entirely closed. No drainage. Left-sided pneumonia. Pericardial friction for two weeks. Recovery. (Case is No. 26 of the cardiorrhaphies in the Obuchow Hospital, St. Petersburg.)

Brewster and Robinson (ANNALS OF SURGERY, March, 1911, p. 324): Gunshot wound over fifth left rib mesial to nipple line. Male, age 28 years. Time between injury and operation, 6 hours. Round hole in anterior wall of left ventricle. Quadrilateral incision, division of cartilages of third, fourth, and fifth ribs, with double intercostal incision. Three catgut sutures, covered by continuous catgut. Death on table. Heart massage was ineffectual.

Brod (1904), quoted by F. Hesse: Stab wound in fifth left intercostal space just outside nipple line, 2 cm. long. Male, age 41 years. Pleura penetrated. Hæmopericardium. Time between injury and operation, 2 hours. Right ventricle, transverse wound 1 cm. Skin muscle flap, partial resection of fourth, fifth, and sixth ribs. Silk suture was applied through apex for better fixation. Silk suture of heart wound. Death on table; failure of massage.

Bufalini (1906) (*La Riforma Medica*, No. 49, 1906, p. 1357): Stab wound in mid-line; sternum pierced. Male, age 27 years. Marked hæmopericardium. Time between injury and operation, ½ hour. Very large hole in right ventricle. Extensive flap and resection of sternum. Ten silk sutures. Small gauze drain penetrating lowermost part of pericardium; removed on third day. Pleura not drained. Course, uneventful. Recovery.

Bufalini (1908) (*La Clinica Chirurgica*, xvii, No. 3, 1909, p. 694): Stab wound in fourth left intercostal space. Male, age 27 years. Hæmopericardium. Time between injury and operation, 3 hours. Wound of right ventricle in middle of anterior surface, 1.5 cm. in length. Enlargement of wound to about 11 cm.; section of third and fourth cartilages and resection of part of sternum. Six silk sutures. Pericardium drained with iodoform gauze. Pleura not drained. Pleuritic exudate; patient up in 20 days after operation. Recovery.

Bufalini (1909) (*ibid.*): Stab wound third right interspace 1 cm. outside parasternal line, 3.5 cm. long. Male, age 21 years. Hæmopericardium. Time between injury and operation, 1½ hours. Wound 1 cm. long, in right auricle. Enlargement of stab wound about 10 cm., exposing right margin of sternum. Section of third and fourth cartilages; partial resection of right half of sternum. Two silk sutures. Pericardium drained with iodoform gauze. Pleura not drained. Severe bronchitis. Wound healed by first intention. Recovery.

Ehrlich, cf. Ranzi.

Erdmann (*Med. Record*, vol. lxxviii, 1910, p. 1095): Stab wound,

¾ inch long, of right chest, penetrating fifth costal cartilage. Male, age 21 years. Hæmopericardium. Time between injury and operation, 4 hours. Right ventricle. Exploratory median epigastric laparotomy; extended upward and seventh, sixth, fifth, and fourth costal cartilages divided; sternum cut across at level of fourth cartilage; 8–10 catgut sutures. Cigarette drain into pericardial cavity. Lobar pneumonia and pneumothorax. Up on fourteenth day. Recovery.

Ewald (*Wiener klin. Woch.*, No. 52, 1909, p. 1817): Two stab wounds in cardiac region, between fourth and fifth ribs. Male, age 23 years. Hæmopericardium. Stab wound in third intercostal space, penetrating pleura. Time between injury and operation, 15 minutes. Small perforation, size of lentil, in left margin of left ventricle. Incision along fourth intercostal space, from middle of sternum, about 12 cm. long. Division of fifth costal cartilage close to sternum. Resection of part of fourth rib. One silk suture of heart wound. Closure of pericardial incision with silk sutures. Pericardium drained with strip of iodoform gauze. No pleural drainage. The complicating pleural wound was not sutured. Slight serous discharge for six weeks. Mild bronchitis and pleurisy. Patient up on fifteenth day. Recovery. "Drainage should be limited to the minimum."

Ferretti (2 cases) (*Atti della Soc Lancis degli Ospedali di Roma.; Jahresbr. f. Chir.*, xii, 1906, p. 705): Penetrating wounds of thorax. Adult males. First case, right ventricle. Second case, left ventricle, near apex. Fontan's procedure, with modifications (osteoplastic flap with pedicle outward). Pleura not opened in second case. First case, death from acute anæmia. Second case, death, forty-ninth day, from secondary hemorrhage, after recovery from purulent pericarditis.

Flörcken (*Münch. med. Woch.*, No. 32, 1909, p. 1634): Stab wound near sternum in fourth left intercostal space, 3 cm. long. Male, age 22 years. Hæmopericardium marked. Time between injury and operation, ½ hour. Right ventricle 2 cm. long. Flap with lateral base; resection of three ribs. Three catgut sutures. No drainage. Mild serous pericarditis. Patient up on sixteenth day. Recovery. Rubber drain was first inserted into pericardium, but was removed when seen to pulsate synchronously with the heart beats.

Foramitti (*Wiener klin. Woch.*, No. 25, 1910, p. 957): Stab wound to right of sternum. Branch of coronary artery wounded. Heart suture. Recovery. "The case is to be reported in detail."

Foederl (1909) (*Wiener klin. Woch.*, vol. xxiii, No. 25, 1910, p. 923): Gunshot wound. Male, age 19 years. Hæmopericardium. Hæmopneumothorax. No tamponade. Time between injury and operation, 2 hours. Left ventricle, 4 cm. above apex. Flap with left-sided base. Suture of heart. Pericardium and pleura washed with salt solution and sutured. No drainage. Uneventful course. Recovery. According to post-operative X-ray, bullet lay near apex.

Foederl (1903) (*ibid.*): Two stab wounds, one above, the other below the fourth rib. Male, age 25 years. Symptoms of progressive hæmopericardium. Pleura intact. Left ventricle, 1 cm. Flap of third and fourth cartilages, without injury to the pleura. Two sutures. Drain-

age of pericardium with gauze. Protracted course; thoracotomy. Recovery. Patient well at time of report, seven years after operation.

Foederl (1907) (*ibid.*): Gunshot wound in nipple line, fifth intercostal space. Male, age 22 years. Complicating injury, gunshot wound in right temporal region. Time between injury and operation, several hours. Wound 5 mm. in diameter anterior wall of left ventricle, 3 cm. from apex. Exit wound posterior wall. Flap 4 fingers' width. Suture of heart wounds. Death after half an hour. Failure of heart massage, salt infusion, artificial respiration.

Friedrich (*Münch. med. Woch.*, No. 4, 1909, p. 210): Stab wound in fifth intercostal space. Adult male. Pneumothorax. Right ventricle. Under differential pressure (Brauer). Flap of soft parts with base at sternum; resection of 10 cm. of fifth rib. Three silk sutures. No drainage. Uncomplicated. Recovery.

Fuchsig (*Centralblatt f. Chir. Beilage*, No. 29, 1911, p. 67): Stab wound of thorax. Perforation of diaphragm. Right ventricle. Suture of heart proved possible through the slit in the diaphragm. Recovery.

Grisogono (*Wiener klin. Woch.*, No. 25, 1910, p. 924): Stab wound in third intercostal space, 3 fingers' breadth from mammary line, 1.5 cm. in length. Male, age 18 years. Pneumothorax; hæmopericardium without signs. Time between injury and operation, ¾ hour. Wound 1.5 cm. long, left auricle. Triangular skin-muscle flap. Resection of third and fourth cartilages for 7 cm. from sternum and 5 cm. of second. Four silk sutures. Pleural cavity drained with gauze through lower angle of wound. Pericardium, no drainage. Pneumothorax. Slow recovery; discharged well two and a half months after operation. A year later practically normal.

Guetig (*Wiener med. Woch.*, No. 43, 1910, p. 2543): Stab wound, 3 cm. long, two fingers' width outside of and below left nipple. Male, age 40 years. Time between injury and operation, ½ hour. Right ventricle, oblique wound, 3 cm. Skin-muscle flap with lateral base, division of fourth and fifth cartilages at sternum; division of cartilages of lower ribs. Interrupted silk sutures. Death on table, after transitory resuscitation of heart by injection of salt solution into left ventricle. Autopsy showed that the heart had been entirely perforated by the knife; tricuspid valve injured; exit orifice 1 cm.

Guidone (*Policlinico Sez. Prat.*, vol. xvi, Fasc. 36, 1909, p. 1135): Stab wound of thorax, 1.5 cm. long. Male, age 18 years. Operation soon after injury. Wound of right ventricle. Resection of sternum and fifth, sixth, and seventh costal cartilages. Five interrupted sutures. Pericardium drained. Recovery.

Guinard (*Bull. et Mem. Soc. de Chir. de Paris*, vol. xxxvi, 1910, p. 162): Gunshot wound, third interspace, 1 cm. internal to nipple line. Male, age 13 years. Hæmothorax, 1½ litres. No signs of cardiac injury. Symptoms of progressive internal hemorrhage. Two holes in base of heart. Three catgut sutures to each wound. No trace of blood in pericardium; it gushed directly into the pleura. No drainage. Emphysema. Death three hours after operation.

Heinrichsen (*St. Petersburger Mediz. Wchschrft.*, No. 45, 1910, p.

632): Stab wound at level of left second rib between margin of sternum and axillary line. Injury to lung. Time between injury and operation, 3 hours. Left ventricle 1 cm. Enlargement of wound, resection of third and fourth ribs. Suture of heart, pericardium, and pleura. Death on second day due to simultaneous injury of lung which had been overlooked.

Heinrichsen (*ibid.*): Stab wound in third intercostal space, mammary line. Right ventricle through entire wall, 1.5 cm. long. Enlargement of wound, resection of third, fourth, and fifth costal cartilages. Suture of heart, pericardium, and pleura. Purulent pericarditis. Death on twenty-first day.

Heller, quoted by F. Hesse: Stab wound, 5 cm., in fifth intercostal space external to nipple. Male, age 22 years. Hæmopneumothorax. Hæmopericardium. Time between injury and operation, one hour. Left ventricle a few centimetres above apex. Triangular flap, with division of fifth, fourth, and third ribs. Resection of sixth rib. Four silk sutures. Pericardium drained. Pleural cavity drained with large tubes. Much serous discharge. Death on third day.

Houzel (*Gazette des Hopitaux*, No. 3, 1911, p. 32): Stab wound, 6 cm., left nipple. Male, age 32 years. Over one hour before operation. Auriculoventricular wound, exposing mitral valve, 5 cm. long. Five catgut sutures. No drainage. Heart stopped a few seconds after application of the last suture. Revived, after 12 seconds, by cardiac massage. Two litres of hot serum poured into thoracic cavity. Death 17 hours later.

The following 21 cases operated at Obuchow Hospital, St. Petersburg:

E. Hesse (1905) (*Beitr. z. klin. Chirurgie*, vol. lxxv, H. 3, 1911, p. 475): Stab wound 3 cm. long, parasternal line, fifth intercostal space. Male, age 19 years. Heart tamponade. Time between injury and operation, 1 hour. Penetrating wound of right ventricle. Flap incision along left sternal margin and fifth rib, base above, resection of sternal segments of fourth, fifth, sixth, and seventh ribs. Three sutures. Drainage of pericardium. Drainage of pleura through wound. Change of dressings on fifth day; tampons soaked. Recovery. Well five years after the operation, with full working capacity.

Ibid. (1906): Stab wound, 1.5 cm. long, in left third intercostal space, anterior axillary line. Male, age 19 years. Wound of lung near base. Time between injury and operation unknown. Wound 1.5 cm. long in anterior surface of left ventricle about two fingers' width from apex. Incision along third rib; resection of 6 cm. of third rib. Application of heart sutures. Death on table.

Ibid. (1906): Stab wound, 2 cm. long, on third rib, 2 fingers' width to left of sternum. Male, age 19 years. Time between injury and operation, 6 hours. Small wound of right atrium. Triangular skin-muscle flap. Resection of fourth and third costal cartilages and part of sternum. Three sutures. Drainage of pericardium. Death 42 hours after operation, acute anæmia.

Ibid. (1907): Stab wound between seventh and eighth left ribs. Male, age 20 years. Time between injury and operation, a few hours. Wound of left ventricle near apex, 1 cm. long. Resection of seventh and eighth ribs. Three silk sutures. Pericardium drained with gauze. Pleural cavity drained with gauze. Empyema. Death on eighth day.

Ibid. (1906): Gunshot wound, in third intercostal space, left nipple line. Male, age 31 years. Hæmopericardium. Operation soon after injury. Left ventricle was obliquely opened, part of myocardium torn away. Sutures were applied deeply, but always tore out. Symptoms of progressive heart failure. Death in 24 hours.

Ibid.: Stab wound over left fifth rib between nipple and parasternal lines, 4 cm. long. Male, age 23 years; exsanguinated. Pleura penetrated. Hæmopericardium. Penetrating wound of left auricle, wound 3–4 cm. long. Six sutures. Death on table.

Ibid. (1907): Stab wound in left nipple line between fifth and sixth ribs. Male, age 17 years. Pericardium filled with fluid blood. Immediate operation. Left ventricle 3 cm. long. Enlargement of wound along sixth rib, which was resected for about 10 cm. Second vertical incision, resection of fourth and fifth ribs, extent of 5 cm. Seven sutures. Pericardium drained. Lung was fixed to thoracic wall. Pneumonia and empyema. Death on fifth day.

Ibid. (1907): Three stab wounds, 2–3 cm., near sternum in region of fifth rib. Male, age 23 years. Stab wound opening abdominal cavity. Right ventricle 5 cm. Incision across sternum, along fifth rib, resection of rib. Four sutures. Death on table, after resuscitation by injection of salt solution into left ventricle.

Ibid. (1907): Stab wound between fifth and sixth rib, in left anterior axillary line. Male, age 15 years. Left ventricle, at left margin, near apex, 1.5 cm. Enlargement of wound, partial resection of fourth and fifth ribs with cartilages. Four sutures. Suture of pleura. Pericardium drained with gauze. Death on third day. Acute anæmia.

Ibid. (1908): Stab wound 2 cm. long, between fourth and fifth costal cartilages, 1½ fingers' width to left of sternum. Male, age 21 years. Stab wound of abdomen, viscera uninjured. Time between injury and operation, 1½ hours. Right ventricle, 1 cm. Skin-muscle flap, resection of cartilages of fifth and sixth ribs. Two deep sutures. Pericardium and pleura closed. No drainage. Pneumonia on fifth day. Empyema, thoracotomy on eighth day. Obstinate septic diarrhœa on twelfth day. Dry pericarditis on fifteenth day. Improvement began fifth week. Discharged, in good condition, in eleven weeks. Well two and a half years after operation.

Ibid. (1908): Stab wound, 3.5 cm., near sternum, over second right rib. Male, age 19 years. Right ventricle, 1.5 cm. Resection of second, third, and fourth costal cartilages and part of sternum. Six silk sutures. Pericardium drained. Bilateral pneumonia, left-sided empyema, purulent pericarditis. Death twenty-fifth day.

Ibid. (1909): Gunshot wound between fourth and fifth ribs, 2 fingers' width to right of nipple. Exit orifice about four fingers' width below

left scapular angle. Male, age 17 years. Wound of left lung. Time between injury and operation, 1½ hours. Left ventricle. Resection of fourth and fifth ribs with cartilages, about 7 cm. Three sutures. Suture of lung wound, pericardium, and pleura. No drainage. Left-sided empyema; thoracotomy. Pericarditis sicca. Right-sided dry pleurisy. Recovery. Two years later, in good health. Radiograph showed presence of adhesions.

Ibid. (1909): Stab wound, 2 cm. above and to right of left nipple. Male, age 28 years. Injury of branches of coronary artery. Time between injury and operation, 4 hours. Left ventricle, anterior surface near apex, 1 cm. Resection of fourth rib. Two sutures. Suture of pericardium and pleura. No drainage. Recovery. Eighteen months after operation good health; slight systolic retraction in the cicatrix.

Ibid. (1909): Stab wound, 2 cm. in anterior axillary line between fifth and sixth ribs. Male, age 20 years. Penetrating lung wound. Left ventricle. Resection of fifth rib. Heart sutures cut through. Pericardium was stitched with heart wound. Pericardial attachment then detached from pericardium and pericardium closed. Lung sutured. Death soon after operation.

Ibid. (1910): Stab wound at right sternal margin, over fifth rib. Walked to hospital. Profuse bleeding. Male, age 17 years. Right auricle, 0.5 cm. long, just below entrance of vena cava. Resection of fifth and sixth ribs to extent of 4–5 cm. Four sutures. Closure of pericardium. Partial closure of pleura. Control of pneumothorax by means of Potain apparatus. Death in 17 hours. Symptoms of progressive heart failure.

Ibid. (1910): Stab wound about 1.5 cm. long, between fifth and sixth ribs, left side, between nipple and anterior axillary line. Male, age 27 years. Time between injury and operation, 1¾ hours. Left ventricle, 2 cm. long about 5 cm. from cardiac apex. Resection of fourth and fifth ribs, to extent of 6–7 cm. from sternum. Three sutures. Suture of pericardium and pleura. No drainage. Left-sided pneumonia, on fourteenth day. Well on twenty-fifth day. Re-examined 8 months after operation, condition good.

The following five cases have been published in a Russian journal, 1904:

Ibid. (1903): Stab wound 1.5 cm. long in second intercostal space, about 2½ fingers' width from left sternal margin. Female, age 25 years. Time between injury and operation, 3 hours. Left ventricle 0.5 cm. Skin-muscle flap, resection of third and fourth cartilages. One suture. Pericardium and pleura sutured. No drainage. Recovery. Ten and a half months later, in good health. Re-admitted 7 years after operation, no disturbance of heart, systolic retraction of cicatrix.

Ibid. (1903): Stab wound 1.5 cm. long in fourth intercostal space, about 1½ fingers' width to left of left nipple. Female, age 30 years. Complicating injury, fracture of skull. Time between injury and operation, 5 hours. Wound about 1.5 cm. long, anterior wall of right ventricle,

close to anterior branch of coronary artery. Skin-muscle flap. Resection of third, fourth, and fifth ribs. Two sutures. Suture of pericardium and pleura. Pleura drained with gauze through wound. Death in 54 hours. Autopsy showed signs of incipient fibrinous pericarditis and pleurisy, chronic nephritis, and a large cranial fissure.

Ibid. (1903): Stab wound 1.5 cm. long in second intercostal space, 1.5 cm. to left of sternal margin. Female, age 22 years. Time between injury and operation, 4½ hours. Right ventricle, 1.5 cm. near septum, 2½ fingers' width from cardiac apex. Flap of third, fourth, and fifth costal cartilages, division of sixth rib at sternal insertion. Five sutures. Suture of pericardium and pleura. No drainage. Steadily rising temperature and dyspnœa. Resection of ninth rib; escape of bloody fluid and clots. Signs of exudative pericarditis. Death on fourteenth day. Autopsy showed that heart wound had completely healed so that the sutures could only be discovered with difficulty.

Ibid. (1903): Stab wound 3.5 cm. long in fourth intercostal space in left parasternal line. Female, age 53 years. Irregular stellate wound in left ventricle, diameter about 2.5 cm. Resection of cartilage and bone of fifth rib, and cartilage of fourth rib, close to sternum. Seven sutures. Death on table. Heart massage unsuccessful.

Ibid. (1904): Stab wound, 1 cm. long, in fourth intercostal space, at right sternal margin. Female, age 35 years. Time between injury and operation, 1 hour. Two transverse wounds of right auricle, about 0.5 cm. long, one below the other. Flap, lateral pedicle of fourth, fifth, and sixth cartilages. Closure of upper heart wound, 1 suture; lower heart wound, 2 sutures. Drainage of pleural cavity, through wound. Death 29 hours after operation.

F. Hesse (1908) (*Archiv f. klin. Chir.*, vol. xcv, H. 4, 1911): Gunshot wound, third left intercostal space, 2 cm. inside nipple line. Male, age 15 years. Hæmopericardium. Time between injury and operation, 1½ hours. Middle of left ventricle 2 cm. to right of margin, orifices on anterior and posterior surfaces. Skin-muscle bone flap base medial including third and fourth cartilages. One and two silk sutures. Rubber drain in pericardium. Two drainage tubes in pleural cavity, scapular line, by resection of rib. Death in seven hours. Heart stopped during the operation; massage failed; injection of camphor 0.75 cm. 20 per cent. solution into heart muscle effective.

F. Hesse, *ibid.* (1909): Stab wound, 1 cm. in length in third left intercostal space, 4 fingers' width from sternum. Male, age 35 years. Time between injury and operation, nearly 3 hours. Left auricle 0.75 cm. long. Resection of ribs and cartilages, also a strip of sternum. Effort to do extrapleural operation failed. Three silk sutures. Large rubber drainage tube into pericardium. Two drainage tubes into pleural cavity in scapular line by resection of rib. Discharge from pleural cavity profuse, from pericardial cavity slight, so that drain was removed on fifth day. Pleural drain left for a month. Recovery. Two years later slight systolic retraction in fifth intercostal space, within nipple line.

F. Hesse, *ibid.* (1909): Stab wound 1 cm. long in third left inter-

costal space near sternum. Male, age 24 years. Pronounced tamponade. Time between injury and operation, 2½ hours. Left auricle, 0.75 cm. Flap with external pedicle of third and fourth cartilages and part of ribs; resection of half of adjacent sternum; section of fifth rib. Pleura opened. Three silk sutures. No drainage. Recovery. Two years later complained of pain after exertion. Distinct systolic retraction in fifth intercostal space.

F. Hesse, *ibid.* (1909): Stab wound, 2.5 cm. long, under left nipple, in fourth intercostal space. Male, age 17 years. Hæmopneumothorax. Time between injury and operation, 3 hours. Left ventricle a little below atrioventricular boundary. Resection of fourth rib from nipple to sternum; opening of pleura to this extent. Five silk sutures. Removal of clots from pleural cavity. No drainage. Pleurisy and pneumonia. Entire wound opened and healed gradually. Recovery. Ten months later free from any disturbance due to the injury.

Iselin (*Deutsch. Ztschrft. f. Chir.*, vol. cv, 1910, p. 572): Gunshot wound, in fourth intercostal space, mesial to nipple. Female, age 20 years. Small wounds in lung. Hæmothorax. Hæmopericardium. Time between injury and operation, 1¾ hours. Small hole in left ventricle, nearer to base than apex. Exit orifice posteriorly, a little larger. Intercostal incision in fourth space beyond anterior axillary line. Suture of both heart wounds with catgut. Suture of lung wounds. Suture of pericardium and pleura after removal of clots. No drainage. Moderate symptoms of pericarditis and pleurisy. Recovery.

Einar Key (*Hadar Liden Hygeia*, vol. lxxi, 1909, p. 1249): Gunshot wound of epigastrium. Boy, age 10 years. Operation 1 hour after injury. Oval wound 1 cm. long in anterior surface of right ventricle, near apex. Incision through wound in epigastric angle, upward through sternal ends of sixth, to fourth left costal cartilages; transverse incision in sixth intercostal space, forming a thoracic flap with its base above. Closure of heart wound with interrupted catgut sutures. Pericardium drained with small tampon which was removed on next day. Drainage of pleural cavity. Empyema. Recovery. Radiograph showed bullet in left wall of thorax.

Kirchner (*Southern Surg. and Gyn. Transactions*, xxii, 1909, p. 171): Two stab wounds in fifth and sixth intercostal spaces about ½ inch in length. Male, age 37 years. Pericardium contained fluid blood. Left ventricle, ¾ inch, near apex. Osteoplastic flap with mesial pedicle at sternum, division of sixth rib. Eight silk sutures. Gauze drain in pericardium. Pleural cavity drained with rubber tube. Death four hours after operation. Autopsy showed another small wound in left ventricle.

Kirchner (*ibid.*): Stab wound ¾ inch, in fifth intercostal space. Male, age 24 years. Time between injury and operation, ½ hour. Left ventricle, 1¾ inches long, 1 inch from apex. Osteoplastic flap, pedicle at sternum. Three deep chromic catgut sutures. Seven intermediate sutures required to control hemorrhage. Two supporting mattress sutures. Rubber drain in pericardium. Pneumonia. Recovery.

Leischner, cf. Ranzi.

McCabe (*Southern Med. Journal*, 1910, p. 540): Stab wound in fourth intercostal space. Female, age 18 years. Time between injury and operation, 2 hours. Right ventricle near centre. Enlargement of original wound, division of fourth costal cartilage. Catgut sutures. Drainage tube into pericardium. Pneumothorax and pneumonia. Death on seventh day.

Magenau (*Beitr. z. klin. Chir.*, vol. lxix, 1910): Gunshot wound slightly mesial to nipple. Male, age 28 years. Hæmothorax. Hæmopericardium. Time between injury and operation, 2 hours. Left ventricle circular wound 1 cm. in diameter, 3 fingers' width above apex. Oval wound on posterior surface. Resection of segments of sixth, fifth, and fourth ribs. Three sutures of linen for each wound. No drainage. Second day pulse gradually disappeared. Pericardium was opened, and much turbid serous exudate escaped. Pulse returned, but patient died suddenly.

Neugebauer (*Münch. med. Woch.*, No. 1, 1909, p. 25): Stab wound 1.5 cm. long above left third costal cartilage near sternal margin. Male, age 21 years. Hæmopericardium. Time between injury and operation, 6 hours. Pericardium was aspirated ½ hour after admission; temporary relief. Right ventricle middle of anterior wall, 1.5 cm. Flap of third, fourth, and fifth left costal cartilages. Removal of half of adjacent sternum. Five silk sutures. Pericardium drained. Change of dressings on second day; escape of large quantity of clear serum, synchronous with heart beats; continued discharge of clear serum for several days. Recovery. Well two months after discharge, heart normal.

Pikin (*Archiv f. klin. Chir.*, vol. xcv, 1911): Stab wounds with scissors, in thoracic region. Female, age 23 years. Wounds of both lungs, liver and diaphragm. Hæmopneumothorax. Left auricle 1.25 cm. Enlargement of pericardial wound to 6 cm. Closure of heart wound with 2 silk sutures. Closure of pericardium with interrupted catgut suture. No drainage. Bilateral serous pleuritis. Recovery.

Pool: Stab wound, ½ inch long, fourth intercostal space just mesial to nipple. Male, 24 years old. Pleural cavity penetrated by knife. Operation less than 1 hour after injury. Left ventricle at margin, ½ inch long, 1½ inches above apex. Flap with lateral pedicle, including third and fourth costal cartilages; section of fifth cartilage. Five vaselined silk sutures in heart wound. Pericardium closed with interrupted catgut, leaving space at lowermost part for drainage. Rubber tissue drain to but not into pericardial wound at lower mesial angle of wound. Free serous discharge for seven days. Up on eighteenth day, discharged on twenty-fifth day. Recovery.

Proust, Bloch, de Cumont. (*Bull. d. l. Societe Anat. de Paris*, vol. lxxxv, 1910, p. 635): Gunshot wound, mesial to left nipple; fifth costal cartilage fractured by bullet. Boy, age 13 years. Pleura opened. Pericardium filled with clots. Time between injury and operation, 6 hours. Left ventricle near apex. Flap formation, division of fourth to sixth cartilages at sternal insertion; four sutures. Very small drain into pericardium. High temperature. Symptoms of pericardial effusion

second week. Nothing drained from tube, which was drawn out, and a large quantity of bloody serous fluid escaped; improvement; temperature normal in less than 48 hours. Patient discharged well one month after operation. Seen two months later in good health.

Ranzi (*Wiener klin. Woch.*, No. 50, 1911, p. 1729): Two gunshot wounds over fifth and sixth left ribs mesial to nipple. Male, 24 years old. Hæmothorax. Time between injury and operation, 5 hours. Left ventricle anterior surface near apex; no exit wound found. Schoenmaker's hyperpressure apparatus used. Skin-muscle flap, resection of fourth and fifth cartilages. Several sutures. No drainage. Empyema; posterior thoracotomy. Recovery.

The following 3 cases, previously unpublished, were likewise operated on in V. Eiselsberg's Clinic.

Ranzi (*ibid.*): Stab wound above left nipple. Female, 20 years old. Moribund. Hæmopericardium. Time between injury and operation, 40 minutes. Left ventricle 1 cm. Sauerbruch's cabinet. Resection of 8 cm. fifth and sixth ribs. Six sutures. No anæsthesia. Death on table.

Leischner (*ibid.*): Gunshot wound 2 fingers' width mesial and below left nipple. Male, 17 years old. Hæmothorax. Two wounds of lung. Time between injury and operation, 1 hour. Near septum 2 fingers' width above apex. Sauerbruch's cabinet. Skin-muscle flap. Resection of fourth and fifth ribs. Three sutures. Lung wounds sutured. Camphor and adrenalin injections into left ventricle. No drainage. Cough with hæmoptysis. Death on second day.

Ehrlich (*ibid.*): Stab wound below and mesial to left nipple. Hæmopericardium marked. Operation 45 minutes after injury. Anterior wall of right ventricle, 2 wounds. Resection of 4 cm. of fourth and fifth ribs. Eversion of third cartilage. Suture of heart wounds. No drainage. Death on day after operation. Autopsy showed another wound on posterior surface of left ventricle.

Rassieur (1903) (*J. Missouri Med. Assoc.*, St. Louis, 1910, vol. vi, p. 316): Gunshot wound in fourth space just below and internal to left nipple. Male, age 20 years. Left lung wounded in lower lobe. Hæmothorax. Time between injury and operation, 3 hours. Left ventricle, ragged laceration midway between base and apex. Resection of one inch of fourth and fifth ribs at costochondral junction. Three silk sutures. Repair of wound of lung. No drainage of pericardium. Gauze drain in pleural cavity. Late secondary abscess. Recovery.

Renner (*Deutsch. med. Woch.*, No. 10, 1910, p. 456): Two stab wounds, one in fifth intercostal space, 3 cm. long, one in sixth intercostal space, 8 cm. long. Male, age 32 years. Wound involved pleura, diaphragm, and peritoneum. Operation ½ hour after injury. Left ventricle 2 cm. long. Flap of third, fourth, fifth, and sixth ribs. Four silk sutures. Suture of diaphragm. Pericardium and pleura drained with rubber tubes. During first days, profuse serous secretion. Pericardial drain removed on ninth day; pleural drain on thirteenth day. Recovery. Patient in good condition nine months later. Renner recommends extensive drainage with tubes.

Schmerz (*Mittlg. d. Vereins der Aertzle in Steiermark*, Nov., 1911,

p. 415): Stab wound 2 cm. long in fourth space at upper margin of fifth rib near sternum. Male, age 21 years. Pleura opened. Operation soon after injury. Right ventricle 2 cm. Skin-muscle flap. Fourth and fifth ribs with cartilages resected 7 cm. Four silk sutures. Pericardial and pleural cavities flushed with salt solution. Lower margin of lung sutured into pleural wound. Gauze drain to pericardial suture. No pleural drainage. Serous pleuritic exudate, twice tapped. Free serous discharge from drainage opening. Recovery.

Schnitzler (*Wiener med. Woch.*, No. 7, 1910, p. 386): Stab wound near left nipple, 1.5 cm. long. Male, age 16 years. Left pleura opened by weapon. Time between injury and operation, ¾ hour. Right ventricle near septum about middle of anterior wall 1 cm. long. Removal of 3 cm. of fourth and fifth costal cartilages. Four silk sutures. Pericardium not drained. Gauze and drainage tube into pleural cavity. (Pleura could not be closed on account of tension.) Left-sided hæmopneumothorax. Right-sided pneumonia. Recovery. Schnitzler mentions, without details, two unsuccessful cardiorrhaphies in his experience.

Schoenborn (1903), quoted by F. Hesse: Stab wound in sixth left intercostal space, 0.5 cm. long. Adult male. Pericardium contained masses of fluid blood and clots. Operation a few hours after injury. Left ventricle. Partial resection of sixth rib. Triangular flap, resection of cartilages and segments of fifth, fourth, and third ribs. Pleura accidentally opened. Four catgut sutures. Drainage of pericardium and pleural cavity. Death on second day. Autopsy showed that the catgut sutures were already so loose that they would probably have given way. No hemorrhage.

Schoemaker (*Monatsschrft f. Unfallheilkd.*, vol. xvi, 1909, p. 225): Stab wound 2 cm. long, close to sternum, over cartilage of sixth left rib. Male, age 26 years. Hæmopericardium. Operation 2 hours after injury. Right auricle. Triangular flap; 5 cm. of sixth cartilage removed; vertical incision along edge of sternum 6 cm. long, dividing fifth and fourth cartilages. Three catgut sutures. Pleura sutured. Pericardium drained with gauze. Removal of drain on third day was followed by large quantity of clear serum, which ceased two days later. Recovery.

Tavel (1909), quoted by König (*Deutsch. Zeitschft. f. Chir.*, Bd. cxii, H. 4–6, 1911, p. 490): Stab wound, fifth intercostal space, 2 fingers' width outside mammary line, 1.5 cm. Male, 22 years old. No increase in cardiac dulness. Pleura penetrated but no signs of hæmothorax. Time between injury and operation 1½ hours. Apex 1.5 cm. long. Flap with mesial base of fourth, fifth, and sixth cartilages and ribs which were divided 2 fingers' breadth external to mammary line. Three catgut sutures. Suture of pleura. Gauze drain to pleura suture. Pericarditic friction. Bronchopneumonia. Up in 4 weeks. Recovery.

Torre, de la Ortiz (*Rev. d. Med. y. Cir. pract. de Madrid*, 1908; *Centralblatt f. Chir.*, No. 49, 1908, p. 1488): Wound in fourth intercostal space, 2 cm. Adult male. Right auricle contained an imbedded piece of glass. Flap of 10 cm. of fourth, fifth, and sixth ribs. Catgut suture. Rise of temperature on fifth day. Evacuation of 700 Gm. of fluid, by puncture. Recovery.

Trendelenburg (Rimann, *Münch. med. Woch.*, No. 15, 1909, p. 760): Gunshot wound, in fourth left intercostal space. Male, age 20 years. Pericardium contained 100 c.c. of fluid and clotted blood. Time between injury and operation about 1¼ hours. Left ventricle, small hole in lower half. No exit orifice found. Longitudinal incision on fifth rib, resection of fourth and fifth costal cartilages. Five silk sutures. Excision of gunshot wound in skin. No drainage. Course favorable. Recovery.

Walther (*Protokolle d. Wissenschft. Veriens der Aerzte des Stadtischen Obuchow Krankenhauses*, St. Petersburg, Nov. 13, 1909): Stab wound in cardiac region. Right ventricle. Heart suture. Recovery. Death from cardiac insufficiency three years and eight months after the operation. Autopsy: Extensive cardiopericardial adhesions. Heart wall very thin in region of cicatrix. No aneurism.

Wesselowsorow (*K. Kaukasian Med. Gesellscht.*, 1910; quoted by E. Hesse, *Beitr. z. klin. Chir.*, 75, 1911): Heart suture. Recovery.

E. Rychlik: Herzverletzung (*Sbornik klinicky*, 1911, xii [xvi], Nr. 3 u. 4) (*Zentralblatt für Chirurgie*, No. 6, Feb. 10, 1912, p. 206): The author reports five cases of wound of the left ventricle.

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PNEUMECTOMY: ITS POSSIBILITIES.

REPORT OF A CASE OF PARTIAL LUNG EXCISION.

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IF the operative removal of portions of the lung should become a procedure attended with reasonable hope of success, certain chronic pulmonary lesions might come to be regarded less as incurable. Malignant growths, actinomycosis, bronchiectasis, chronic interstitial pneumonitis belong to this obstinate group, and certain selected cases of advanced tuberculosis may also be included. Diseases of like gravity in other organs of the body are regarded as within the scope of surgical relief; but the operative results in these chronic thoracic diseases are by no means brilliant. Some fatal attempts have been reported, many others doubtless have not been, and a few successes are on record—too few, however, to indicate that surgical treatment is any more successful than palliative medicinal treatment in these so-called incurable pulmonary diseases.

HEIDENHAIN in 1898 reported a successful removal of the left lower lobe for bronchiectasis. Two previous operations had been performed with drainage of several large bronchiectatic cavities. Rib resection had been performed at each of the preliminary operations. The conditions under which the final excision was performed were strikingly similar to those of the case reported in this paper.

LOWSON in 1893 described the successful removal of a tuberculous lung apex the size of "half a fist." TUFFIER in 1891 delivered a lung apex through an intercostal incision and removed a portion of it. DOYEN in 1898 resected the remains of a right lower lobe in which a large hydatid cyst had previously been drained.

PROFESSOR GARRÉ of Bonn stated to me in 1908 that he had excised a lower lobe for bronchiectasis by first resecting a sufficient number of ribs to cause a caving in of the chest wall sufficient to permit of the delivery of the lobe and the extrathoracic treatment of the stump at a subsequent operation.

BREWER in Keen's "Surgery" illustrates a case from the private clinic of Leonard Freeman, in which a gangrenous lower lobe had been excised previous to a complete Schede operation for empyema.

RICHARDS, FORDE, HALL, and GRINNELL, 1837–1880, publish four cases of hernia of portions of the lung resulting from the withdrawal of grass-cutting tools, spears, arrows, etc. In each case the protruding lung tissue was ligated outside the thorax and the wounds sutured. Complete recovery occurred in each case.

The case of HELFERICH reported by Gerulanos has been frequently cited in connection with lung excision because two lobes were amputated. Death occurred in 24 hours, however, and it is questionable if the case should even be recorded as evidence that such an operation is technically possible.

In view of this limited number of successful cases reported, it is not surprising that lung excision is commonly regarded as an unwarranted risk. And yet a careful consideration of the apparent obstacles to success and possible means of overcoming them leads me to the conclusion that lung excision will eventually justify its existence as an operative risk.

Were fatalities previous to 1904 due to operative pneumothorax, the effects of which at that time were not overcome by the use of differential pressure? It is indeed disappointing that the general adoption of positive and negative pressure and intratracheal insufflation is not yet attended by better results in lung excisions in human beings. Differential pressure has, to be sure, rendered possible all thoracic operations in certain animals susceptible to pneumothorax. There has thus developed extensive experimental investigation concerning the technic of thoracic operations. Lung excision in dogs is attended with almost surety of success.

Yet despite the arrival of differential pressure eight years ago, the medical literature is still devoid of reported successful lung excisions for chronic disease.

From this we may conclude that the operative pneumothorax has never been the sole obstacle to success in this group of chest cases, and that we must look elsewhere for the real causes of failure.

The solution of the problem seems to rest in the fact that the pathological changes coincident with these pulmonary

diseases, in which excision would seem to be indicated, are in themselves added obstacles to the removal of the diseased lung.

In the first place, the patients affected with these chronic ailments are either cachectic from progressive malignant disease, or reduced by prolonged inflammatory processes. In such cases other organs of the body are rarely wholly normal in function. Amyloid changes may be coincident and albuminuria is generally present.

Prolonged illness, loss of weight, and a greater or less degree of toxæmia have furthermore lowered the resistance of such patients to operative injury to nerve endings. Such nerve trauma is greater in thoracic than in abdominal operations. Extensive rib resection is a preliminary shock. Irritation of the vagus terminals of the pleura is constant throughout the operation, not only from necessary retraction of a rigid wound, but from traction on lobes of the lung resulting in a stretching of the reflected pleura around the hilus. Direct contact with the pneumogastric or phrenic nerve not infrequently occurs in the approach to lesions adjacent to or within the mediastinum. Ample evidence is further presented that sudden changes in temperature, to which more or less of the pleural cavity is suddenly exposed at operation, produce shock. Even though the atmospheric air be warmed to body temperature, the respiratory excursions in the presence of open pneumothorax result in a rushing of air in and out of the pleural cavity whenever the wound opening is partially obstructed. The heat loss from the radiating pleura is in itself an additional factor in lowering the patient's resistance to shock.

In most chronic pulmonary affections, especially bronchiectasis, abundant sputum is present. The presence of such encountered at the time of operation has always been regarded as a danger, on the ground that if accumulating to the level of the bifurcation of the trachea, purulent secretions may be inhaled to the sound lung to implant subsequent infection.

I have come to regard aspiration infection after operation as an even greater danger.

If all the diseased secreting portions of the lung could be removed or isolated at the first thoracotomy, the dangers of subsequent accumulations would be obviously eradicated. A radical one-stage operation is necessary to accomplish this, even under the most favorable circumstances. It is a disputable question whether the excision of even one lobe should be done at one sitting, and if the bronchus is not drained at the first operation the sputum will continue to accumulate proximally. It is a commonly accepted fact that after any operation for suppurative intrapulmonary processes sputum ceases for from 24 to 60 hours. In the interim, coughing and expectoration are prohibited by pain produced in the thoracic wound. The presence of closed or drained pneumothorax diminishes the expulsive power of the chest wall against the lung. As a result of these post-operative conditions, the purulent secretions remain stagnant. A rattling in the trachea eventually shows that the mucopus has reached a level which permits inhalation to the opposite main bronchus.

This retention of sputum results in a rise in temperature from septic absorption. The chances of lymphatic or hæmatogenous extension of infection are increased. The blocking of the main bronchus incapacitates the aerating surface of the remaining lobe or lobes of the operated side. A varying amount of cyanosis results. Although patients in this desperate predicament will sometimes accumulate strength to expel the sputum, this secretion complication is indeed an important element in determining the end result of chest operations for inflammatory pulmonary disease. That we may yet develop means of obviating it is probable; but I am of the opinion that retention of sputum alone has often led to fatalities, either directly by obstruction or indirectly through toxæmia and remote metastatic abscess formation.

Another conspicuous contrast in human thoracic operations to those upon the dog is to be found in the adhesions ever present in these chronic pulmonary diseases. The ap-

proach to the hilus of a single lobe is invariably made difficult by tough adhesions to the parietal pleura, pericardium, or adjacent lobe. The separation of these is generally attended by evidences of shock from nerve stimulation. Hemorrhage is almost inevitable as a result of the often necessary lacerations of the lung parenchyma. In other words, the mere preparation of a given portion of the lung for excision is in these chronic cases a major procedure. The extensive rib resection commonly preceding it has already produced shock; and by the time adhesions have been separated and the vessels at the hilus have been exposed, the resistance of the patient has been seriously lowered.

We have mentioned above that the immediate effects of operative pneumothorax, undoubtedly a danger to certain individuals, is obviated by the modern use of methods to maintain oxygenation in spite of partial or complete lung collapse.

Post-operative pneumothorax, on the contrary, is unquestionably a hindering factor, and has doubtless had more to do with fatalities than is generally supposed.

Although even total pneumectomy is generally successful in normal animals operated upon under differential pressure, such has been the truth only when the thoracotomy wound has been closed tightly with a considerable degree of negative pressure established in the emptied pleural cavity previously or immediately subsequent to closure. Animals left with leaking wounds have rarely recovered, and the establishing of a definite drainage immediately after a clean operation will invariably result fatally.

Excision of a lobe of the lung for pulmonary disease in the human being with immediate permanent closure of the chest wall opening has never been successfully performed, and it is doubtful if such technic will ever be justifiable. Hemorrhage from separated adhesions is rarely entirely arrested, and the drainage of such ideal culture medium is generally indicated. Trauma to the diseased lobe in the process of freeing adhesions doubtless releases infection. Amputation of an infected lobe, unless under ideal conditions, must further

introduce bacteria to the pleural cavity. In other words, drainage must generally be established.

A closed or partially open post-operative pneumothorax is the necessary accompaniment of drainage. The effects of post-operative pneumothorax depend somewhat upon the degree of fixation of the remaining organs bounding the persisting pleural space. If the remaining lobe or lobes of the operated side are adherent and immobile, they may still functionate, although to a limited degree, because of the lack of negative suction normally applied to their surfaces at inspiration. If non-adherent they must remain collapsed in the presence of pneumothorax, and the aerating lung surface already reduced by the removal of the diseased lobe is again diminished by the destroyed function of the lobes remaining. If the mediastinal partition is held rigid by its own inflammatory thickening or by pericardial adhesions, the function of the lung of the unoperated side should not be hampered even in the presence of pneumothorax. On the other hand, if the mediastinum is movable it will oscillate with respiration because of the normal negative pressure on one side of it and atmospheric or slightly negative pressure on the other side. This mediastinal oscillation has been explained by Garré and Quincke to restrict both the inspiratory and expiratory function of the lung of the unoperated side.

The chief obstacles to the operative removal of portions of the lung in chronic diseases have been enumerated. In venturing suggestions as to means of overcoming these obstacles, I base my conclusions on the successes and failures of more than 100 thoracic operations of my own, and upon a study of the apparent causes for failure and success in cases reported by others; and lastly upon a long series of experimental investigations.

It is obvious that the duration of the disease and the resistance of the patient to it are of primary importance in considering the advisability of operation. As in progressive surgery of the other regions, the uncertain prognosis by operation is an ever-present obstacle to the prompt transfer of the

patient by the internist. When presented for operation, therefore, these patients are generally much reduced.

The reduction of surgical shock is unquestionably of primary importance. This will consist essentially in avoiding a one-stage operation. The necessary resection and retraction of ribs, the separation of adhesions and coincident trauma to the pleura, traction on the lung and direct nerve injury in manipulation are three factors in the excision of lung tissue which are perhaps too great to be borne at one operation even by the most resistant subject. Dividing the procedure into stages applicable to all cases is obviously impracticable and must be determined in accordance with the conditions present.

In bronchiectatic cases with abundant sputum, provision should be made not only to prevent the post-operative retention of septic secretion, but also to prevent its aspiration to the sound lung at the time of operation. W. H. Smith has suggested the advisability of prescribing an emetic an hour before operation which invariably empties the terminal as well as the main bronchi. A semi-sitting posture during operation is essential. During the exploration of the infected lobe a temporary elastic ligature may be placed at its hilus until external drainage has been procured by pneumotomy.

Rib resection alone without subsequent opening of the pleura is a faulty division of stages in the suppurative bronchiectatic cases because of the dangers mentioned above of post-operative retention of sputum. In three cases of bronchiectasis I have resected the ribs over the lower lobe, intending this as a preliminary to subsequent resection provided the collapse therapy in itself (Friedrich) should not result in a relief of symptoms. Two of these cases resulted fatally without subsequent opening of the pleura, solely because of the stagnant retention of infection secretions.

In sputum cases, therefore, the first stage must at least include the opening of the pleura, and the patient should not be allowed to come out of ether until either pneumotomy for external drainage has been performed, or a temporary mass ligature has been applied to the lobe. If in the presence of

pneumothorax the lobe collapse is extreme, the subsequent accumulation of secretion may not appear as threatening.

The second stage in such inflammatory cases should consist in freeing adhesions to render the vessels and bronchus at the hilus accessible. If such adhesions are resistant and their separation results in lacerations of the lung surface with hemorrhage, it is preferable to pack away the infected lobe and to allow an interval of a week before the final excision. If on the contrary the infected lobe can be freed readily, amputation may be at the same operation, thus avoiding a third stage. If amputation is deferred to a third operation, the technic should depend upon the conditions present. Space does not admit of a discussion of technic, but generally speaking I am convinced that the preservation of a certain amount of lung tissue at the root of the lobe is a valuable factor in producing hæmostasis and air-tight closure of the large bronchi. There is no evidence that disease will recur in this small stump of pulmonary tissue. It ceases to functionate and becomes a cicatrized mass.

Garré's successful case embodies the first two stages mentioned, namely, rib resection, delivery of the lobe with constriction of the bronchus sufficiently to retain secretions within the lobe. Being extrathoracic, the lobe can then be amputated when its condition indicates it. Sauerbruch and I performed a number of experiments to determine the success of this method in animals. Our mortality was 100 per cent.; but it may be argued that the animals died from the post-operative pneumothorax resulting from leakage around the root of the delivered lobe. The adhesions invariably present in man doubtless prevent the collapse of the lobes remaining within the chest—in other words, the susceptibility of the patient to post-operative pneumothorax is greatly reduced.

Unquestionably the successful results of Heidenhain's case and my own are due to the several stages in which they were performed. In Heidenhain's case the secretions had been largely provided with external drainage by previous thoracotomies. In my patient the exploratory operation by W. M.

C. resulted in a partial collapse of the lower lobe with accompanying empyema, the quantity of sputum meanwhile being materially reduced by the collapse therapy.

When pneumectomy is performed for conditions in which sputum is not an obstacle, rib resection, thoracotomy, and freeing of adhesions may be withstood in one stage; but there is reason to believe that success in such cases will depend essentially in postponing at least the amputation to a later operation. During the first stage when the lobe to be amputated has been separated from the adjacent lobe, if the latter is not also adherent to the parietes it should be sutured to the edge of the wound to diminish the effects of the open post-operative pneumothorax.

Although the division of lung excision into suitable stages should in itself greatly diminish the immediate and latent effects on the nervous system, anoci-association as described by Crile can doubtless be employed further to protect the brain from harmful associations. The use of gas and oxygen introduced through a mask or intratracheal tube is being employed in thoracic operations to replace ether. Novocaine can be injected into the external wound tissues and applied by compression to the rib periosteum. Trauma to the pleura can doubtless be minimized if due thought is given to this important source of brain cell destruction. The injection of quinine and urea to the wound portion of the parietal pleura may diminish post-operative sensitiveness so that the operated chest may share in respiration without causing pain.

We have admitted that post-operative pneumothorax is doubtless an obstacle to success in lung resections. We may believe that the dangers of pneumothorax at the time of operation are satisfactorily obviated by the use of apparatus. It must be emphasized, however, that although differential pressure or intratracheal insufflation be applied to the patient, the susceptibility of individuals to operative pneumothorax varies, and that the amount of assistance which they need from apparatus to prevent the onset of unwelcome symptoms varies within wide limits. Ill applied or excessive use of

these methods then must be avoided, to prevent an excess of pulmonary pressure and overwork to the right heart.

The effects of post-operative pneumothorax may be partly overcome by closing the external wound as tightly as possible around the drainage; or even by closing the wound tight for the first 24 hours, though subsequent reopening is inevitable. Adhesive plaster support to the operated chest is of value. If in spite of these provisions against the immediate effects of post-operative pneumothorax, respiratory and circulatory symptoms arise, positive pressure should again be applied with a mask, anæsthesia not being necessary for this particular method. In this way the interim previous to the formation of new adhesions may be rendered less alarming.

The following case is reported as further evidence that lung excision is at least possible by the several stage method. It is evident that excision as an ultimate procedure was not planned by W. M. C. at the primary operation, nor perhaps by C. A. P. at the second operation; but the fact remains that these two preliminary stages were unquestionably responsible for the success of the final excision. Two years and four months have elapsed since the removal of the lower lobe. The patient is sputum-free and able to work. There is a slight discharge from two small persisting bronchial fistulæ. Heidenhain argues that the fistulæ persisting in his case should not and could not be closed because of the bronchial secretion which comes from them. I am not of this opinion in regard to my own case, unless it should prove that the open fistulæ are draining secretions from the upper lobe through the main left bronchus to the lower lobe.

Although the following case has not been typical of bronchiectasis, the presence of influenza bacilli in the original sputum with the extensive formation of interstitial pneumonitis in the specimen leads me to accept the diagnosis of bronchiectasis.

Case I.—J. R. C., dredgeman, single, aged thirty-six.

Family History.—Negative as regards possibility of inherited predisposition to disease.

Past History.—Syphilis nineteen years ago, followed by two years of treatment. A lesion, probably tertiary, on left leg three years ago. Anthrax infection of back of neck eight years ago. Malaria four years ago with occasional chills since.

December 1, 1908: *Present Illness.*—Patient has been coughing for one year. Nine months ago afflicted with increasing shortness of breath. Six months ago "took cold"; was feverish, and entered hospital in Portland, Maine, for one month, in which time there were fever, chills, dyspnœa, and night-sweats.

For past four months has been at Boston City Hospital with continuing symptoms, including an increasing cough accompanied by thin mucopurulent sputum, never containing blood. Thoracentesis performed at City Hospital four months ago; 55 oz. of fluid withdrawn with accompanying relief of dyspnœa. Six weeks later negative thoracentesis performed. Temperature has oscillated from normal to 103°.

December 1, 1908: Entered medical service of Massachusetts General Hospital.

Physical Examination.—Scars on right side and back of neck. Marked deviation of nasal septum. Pupils equal and reacting normally. Throat negative. No glandular enlargement. Heart: Apex 3¾ inches to left of midsternum. Left border not made out. Right border just to the right of right sternal margin. Systolic murmur heard at the apex not transmitted. Arteries not palpably sclerotic. Lungs: The left chest presents flatness and absence of breath and voice sounds from the fifth to the seventh rib in front and below the inferior angle of the scapula posteriorly. There is dulness and diminished breathing from the second to the fifth rib in front and over a corresponding area posteriorly. The left apical region presents dulness, harsh bronchovesicular breathing, and increased voice and fremitus both anteriorly and posteriorly. Right chest presents no abnormalities. Abdomen: Liver dulness extends from sixth rib to 3 inches below the costal margin in the right nipple line. Spleen not felt. Genitalia normal. Knee-jerks normal.

Weight, 148 lbs.; temperature, 98.6°; pulse, 90; leucocytosis, 12,000. Urine: Normal except for occasional hyaline cast. Blood-pressure: 126 mm. Sputum: Green and mucopurulent. Influenza bacilli present; also a few pneumococci. Tubercle bacilli absent.

December 8, 1908: Temperature, 101°; pulse, 100; leucocytosis, 20,000. Sputum profuse and of same character; 24-hour amount, 16 oz. The signs in the lungs remain the same except that breath sounds are more audible at the left base.

December 15, 1908: Night temperature, 103°; morning temperature, 98.6°; leucocytosis, 32,600. Sputum abundant, mucopurulent, and constant. Negative search for elastic fibres. Urine: Slightest possible trace of albumin. Many hyaline and granular casts. A violent attack of coughing accompanied by rise in temperature. Left chest was filled at the time with coarse and medium moist râles. *Preliminary diagnosis:* diffuse bronchiectasis.

December 27, 1908: Temperature and pulse normal. Sputum abundant, greenish, purulent. Influenza bacilli in diminished numbers. Patient out of doors daily with improvement in general condition.

January 13, 1909: Temperature, 101.6°; pulse, 100; leucocytosis, 35,000. Sputum abundant. General condition not changed though great discomfort accompanies night rise in temperature. Examination of the left lung shows slight tympany below the clavicle, amphoric breathing and suggestion of cracked-pot sound.

January 26, 1909: Leucocytosis, 49,000. Sputum contains many intra- and extracellular influenza bacilli. No elastic fibres. Negative thoracentesis performed in the eighth interspace midway between posterior axillary line and vertebral column. Patient transferred to the surgical service with following diagnosis: chronic fibrous pleuritis; chronic bronchiectasis of left lung; abscess of lung (?).

January 28, 1909: Operation (W. M. C.): Crescentic incision made over the sixth rib. Fifth, sixth, and seventh ribs resected from costochondral junction to posterior axillary line. Parietal pleura incised exposing adherent lung. Adhesions broken up between both lobes and parietes, and also between upper and lower lobes. A transverse incision made in the lower lobe and explored digitally. Lung tissue grayish in color and of tough consistency. Hemorrhage profuse. No pus found. Specimen of lung tissue excised for pathological examination. Wound in lung packed with gauze. Two wicks placed to the general pleural cavity.

Pathological Report (by Dr. W. F. Whitney).—A piece of

tissue removed from the lung, the pleural surface dense and fibrous and the lung tissue more or less solidified. Microscopical examination showed the alveoli filled with fluid and desquamated cells. Many of the smaller bronchi were filled up, and here and there the infiltrated tissue was softened and broken down. *Chronic bronchopneumonia.*

Patient required some stimulation in first two days following operation. Semi-sitting posture necessary to prevent dyspnœa. Discharge from wicks purulent and foul on the sixth day. The right lung normal and free from râles. Two weeks after operation discharge foul and profuse.

February 25, 1909: Discharged to convalescent home. *Diagnosis:* chronic bronchopneumonia; secondary operative empyema.

May 25, 1909: Cough has been persistent since operation. Patient otherwise comfortable except when drainage of empyema has become obstructed. Right lung remains normal.

Evidence that empyema cavity required plastic operation to diminish its size and complete its drainage.

May 29, 1909: Operation (C. A. P.): Incision from below inferior angle of scapula to left sternal border. Eighth and ninth ribs excised. Underlying tissues removed, exposing empyema cavity which was cleaned and drained. Skin and muscle flap replaced around drainage tube.

Convalescence from operation during following two weeks was uninterrupted.

June 21, 1909: Discharged to convalescent home. *Diagnosis:* Chronic empyema.

July 3, 1909: Referred to Main Hospital from Out-Patient Department because of chill, nausea, and vomiting occurring during the previous night. Temperature, 103.6°; pulse, 130; respiration, 42; leucocytosis, 28,000.

Patient remained in hospital four weeks, in which time his general condition returned to normal. Gradual fall of temperature was accompanied by increased purulent discharge from wound.

July 31, 1909: Discharged relieved to local physician.

October 18, 1909: Since last note patient's condition has been unchanged except for gradual increase in strength and weight. Discharge from empyema wound continues to be profuse; cough

is persistent and annoying, especially at night, accompanied by considerable mucopurulent sputum.

Patient advised that his diagnosis was obscure, but that the disease was both intra- and extrapulmonary, and that removal of the more infected portion of the lung was necessary.

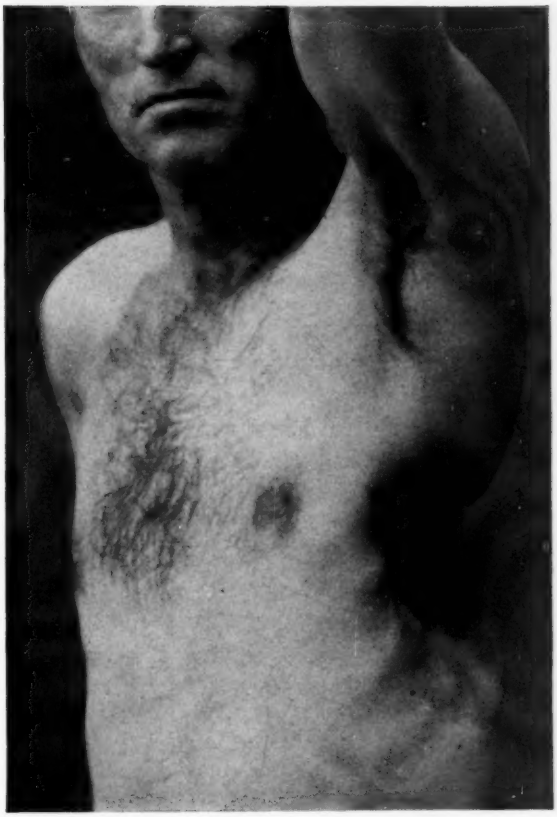
Operation, S. Robinson. Anæsthetic (anæsthol, ether, and oxygen), Dr. Allen.

Patient placed in right semi-recumbent, semi-lateral posture. A curved incision with its convexity upward to include the scars of previous operations and the drainage wound. Muscle and skin flap reflected downward; posterior ends of ribs previously excised removed sufficiently to admit the hand freely into the pleural cavity. Adhesions extensive, preventing any indications of embarrassed respiration. Both upper and lower lobes separated from the parietes with considerable difficulty and some bleeding. Adhesions in fissure between upper and lower lobes also broken up.

Although patient's condition not alarming, it seemed advisable to complete excision of the lower lobe at a second-stage operation. The entire lung was packed away from the parietal pleura except at the apex with handkerchief gauze. The lower lobe appeared to be of firmer consistency than the upper, although the latter was firmer than normal. The patient recovered from preliminary operation during the following thirteen days, in which time the original gauze packing was not disturbed.

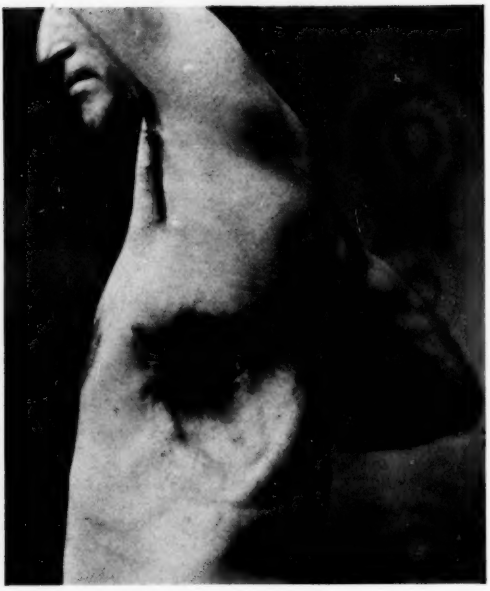
November 1, 1909: Second operation: Anæsthetic, anæsthol, ether, and oxygen. Incision of last operation lengthened to 10 inches. More of eighth and ninth ribs removed, permitting free access to the entire lower half of the chest cavity. Removal of the gauze exposed the lower lobe free from adhesions. The lower lobe was then clamped 1½ inches from its root. Amputation performed distal to the clamp. The clamp then slipped from the unyielding lung tissues, permitting profuse hemorrhage from several points in the stump together with leakage of air through exposed bronchi. The large vessels were clamped separately and a mass braided silk ligature applied around the root of the lower lobe. Patient's condition somewhat threatening. Large gauze packed into pleural cavity around amputation

FIG. 1.



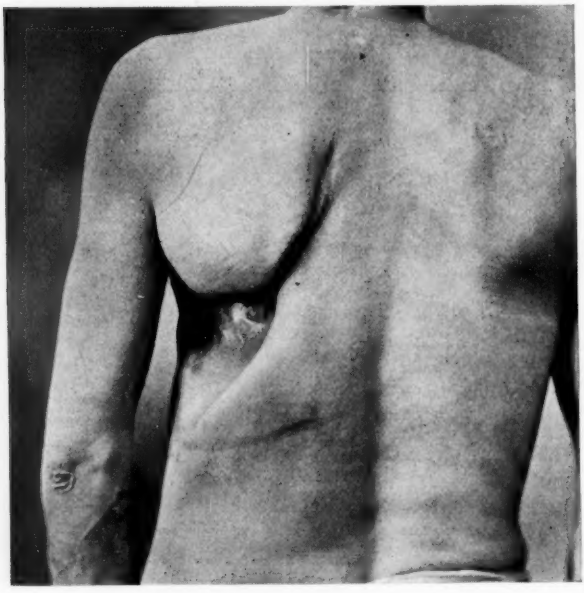
Amputation of the lower lobe of the left lung. Recovery. Photograph taken 16 months after operation. (Anterior view.)

FIG. 2.



Amputation of the lower lobe of the left lung. Recovery. Photograph taken 16 months after operation. (Lateral view.)

FIG. 3.



Amputation of the lower lobe of the left lung. Recovery. Photograph taken 16 months after operation. (Posterior view.)

stump. Skin and muscle flap only partially replaced with through-and-through silk sutures.

Convalescence from second operation surprisingly good.

Fourth day after operation: Patient subjectively in better condition than for many months.

Eighth day after operation: Gauze removed without hemorrhage, also silk stay suture.

Tenth day: Patient out of doors in wheel chair. Sleeping well.

Seventeenth day: Wound cavity visible and clean with no sloughing; patient walking.

December 7, 1909: Evidences of bronchial leakage in the stump disclosed by whistling noise during coughing. Coughing since operation has been slight up to this time.

December 18, 1909: Discharged relieved to Out-Patient Department with gain in weight, absence of sputum, and a dry reflex cough.

June 23, 1911: During past year and a half, patient's general condition has been distinctly better than for the past four years. The skin flaps left unsutured have retracted into the exposed cavity and become adherent in better position than if they had been sutured to bridge the cavity. New skin has extended inward from the flaps sufficiently to cover the base of the cavity with the exception of two square inches, in the midst of which are four small bronchial fistulæ. Exploring these fistulæ with a probe causes a reflex spasm of coughing, during which the diaphragm from below and the mediastinum and the heart from within bulge prominently. There is a slight mucopurulent discharge from these fistulæ, but the reflex cough is not accompanied by sputum.

Patient advised to undergo an attempt at closure of the fistulæ to relieve the cough.

July 7, 1911: Operation (S. Robinson). Ether. Parallel curved incisions made producing a skin and muscle flap from the region of the left erector spinæ muscle. Mucous membrane of four fistulæ dissected proximally for a distance of ¼ inch, curetted, and ligated with catgut. The skin and muscle flap then swung transversely to cover the fistulous areas. The skin medianwards to the fistulæ which was free for approximation with the tip of the flap was thin and devoid of subcutaneous

tissue, and the line of approximation with the flap was threateningly near two of the ligated fistulæ.

The area bared by the transplantation of the skin and muscle flap was left open to granulate. One week after operation there was evidence of bronchial leakage through the suture line in the neighborhood of the two median fistulæ.

August 12, 1911: Cough has been greatly diminished and the discharge from remaining fistulæ much less than before operation. Patient discharged to Out-Patient Department. *Successful closure of two out of four bronchial fistulæ.*

December 4, 1911: Through the courtesy of Dr. D. C. Malcolm, of the General Public Hospital, St. John, New Brunswick, the following note is added as to the patient's recent condition: "The wound has become covered with epithelium, with the exception of an area almost an inch square one inch above the lower angle of the scapula, and half an inch in front of it. There are two bronchial fistulæ; the larger, about 5 mm. in diameter, is under the anterior border of the bone in the uncovered area above described, with a smaller one to the front of it. The discharge is greatly lessened to what it was before the last operation."

The accompanying three photographs illustrate the deformity resulting from the removal of the left lower lobe.

I am indebted to several members of the Surgical Staff of the Massachusetts General Hospital for submitting the care of this patient to me, and especially to Dr. C. A. Porter for his advice and assistance.

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TUMORS OF THE MALE BREAST.*

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THE infrequency of tumors of the male breast is explained by its rudimentary state, the physiologic inactivity of its glandular elements, and particularly by the fact that the conditions incident to pregnancy, which predispose to mammary disease in the female, are entirely absent.

The degree of frequency is well demonstrated in Williams's analysis of 13,894 primary neoplasms, which show that 2422 originated in the breast; of these, 25 occurred in males and 2397 in females. Therefore, 17.5 per cent. of all neoplasms occur in the breast, and when subdivided, we find that the female breast is relatively affected in 26 per cent., and the relative frequency in the male breast is 5 per cent. The influence of sex in the development of neoplasms is thus demonstrated. Williams estimates, in general, that females are twice as liable as males, the percentage proportion being 67 females to 33 males. In the breast, however, nearly 99 per cent. of all its neoplasms occur in females, and only about 1 per cent. in males. This illustrates the law that functionless, obsolete structure has but little tendency to take on the neoplastic process, which is most prone to arise in the sites of greatest post-embryonic developmental activity.

CARCINOMA.

In spite of the fact that carcinoma of the male breast, when compared with the same disease in the female, is relatively infrequent, there are a sufficient number of cases re-

* Read before the Philadelphia Academy of Surgery, January 8, 1912.

ported in the literature to give to this affection a degree of considerable importance. This importance is further emphasized by a comparison of the disease in the two sexes, a study which tends to bring out many distinct differences.

Of the 25 tumors of the male breast collected by Williams, 16 were carcinomata, 3 sarcomata, and 6 various forms of benign growths. In 1885, Schuchardt collected 406 cases, 348 of which were malignant; Manger, in 1902, referred to 71 cases—some of these were probably included in Schuchardt's statistics. In 1901, Warfield collected 37 cases of cancer reported since the publication of Schuchardt's paper, and in 1906 Finsterer added 11 new cases. In addition to these, about 30 other cases have been recorded, making an approximate total of 500 instances of cancer of the male breast.

Carcinoma of the breast occurs considerably later in life in men than it does in women. In the latter, the statistics of various authors vary from 45 to 49 years, and in males the average age is about 55 years (50 years, Williams; 61.5 years, Keyser). The greatest number occurred in the seventh decade of life in both Warfield's and Manger's series, although a relatively large number also appeared in the fifth and sixth decades.

The disease may occur at an early age, as is seen in the case reports of Blodgett, Williams, Moore and Coley, in which the ages were respectively twelve, twenty and twenty-two years. The oldest case on record occurred in a man aged ninety-one (Lunn).

A definite history of injury to the breast is obtained in a sufficiently large number of cases to attach some importance to traumatism as a predisposing factor in the development of cancer. It was mentioned in 8 of 37 cases (Warfield), and Schuchardt found that contusions, small wounds, fissures and mechanical factors, were present in 25 of 406 cases. In those instances in which traumatism was followed by either blood extravasation or scar formation (Schuchardt, Dietrich, Moore), there can be little doubt that the carcinoma devel-

oped at the site of lowered vitality. In one of Dietrich's cases, after the absorption of a hæmatoma, a nodule remained, and from this a malignant growth began two years later. In a second case a blow was followed by an inflammatory tumor discharging pus, and at this spot a hard nodule developed and later became carcinomatous.

The effect of constant pressure is noted in the appearance of cancer in workmen, who, in their occupations, are accustomed to exert force in the breast region. These cases are so numerous that the etiologic importance of this factor cannot be overlooked. The chronic irritation of articles of clothing is also mentioned, and it is certain that constant rubbing in this manner seems to hasten the growth of the tumor, and certainly predisposes to ulceration in those cases in which the carcinoma has already developed.

The action of the process spoken of as adolescent mastitis in the production of benign tumors will be alluded to. That the same affection may cause a predisposition to cancer seems likely, to judge from the first case reported by the author, in which the malignant growth was preceded by several attacks of inflammation.

The effect of hereditary predisposition in the development of tumors has been mentioned by several authors, a family tendency existing in benign as well as in malignant tumors of the breast. Gangitano has recently reported two cases of benign tumors in which the families of both showed a predisposition to breast disease. According to Williams, there was a history of cancer in seven of 29 cases (24 per cent.). Of the seven cases, the breast was the seat of the cancer in three, and in three cases there was history of carcinoma in more than a single relative.

Traumatism, or some form of chronic irritation, tends to produce rapid enlargement of latent carcinomata, and the same factors are often instrumental in producing ulceration. The formation of an ulcer is more likely when the malignant process has extended to the overlying skin which becomes atrophic in appearance. The frequency of ulceration is noted

by many writers, occurring in 61 of 219 cases (Schuchardt), 9 of 26 (Williams), 13 of 37 (Warfield), 18 of 71 (Manger). About 30 per cent. of the cases, therefore, undergo ulceration, a percentage which is much higher than in the breast carcinomata of women.

The slow growth of the tumor probably accounts for the fact that from the time when first noticed until the patient came under observation, a period of 29.5 months elapsed on the average (Williams), 18 to 25 months (Finsterer). In females, this period is much less, and varies from 10 to 12 months. While the growth of the tumor is protracted in most cases and covers a period of many years in slowly growing scirrhous tumors, the length of time observed has been as short as two weeks (Moore), two months (Finsterer) and three months in the first case reported by the author.

Enlargement of the axillary lymph-nodes is observed in a majority of the cases (60 to 65 per cent.). In a few instances, no axillary enlargement was noted, and in cases whose duration was not longer than six months, the nodes were usually normal. After this period of time, as in the female, the lymphatics become affected regularly.

Some authors have found that the right breast is affected more frequently than the opposite one, whereas, other statistics place the degree of frequency slightly higher in the left. The average of a large series of cases, however, shows that the difference is so little that it is not of practical importance. The disease was bilateral in four of 88 cases (Williams), but did not begin as a primary bilateral affection in any case. Hansy reports a case in which the second tumor in the opposite breast developed so soon after the appearance of the first, that it can be regarded as an example of bilateral primary malignancy.

The clinical picture of the disease does not differ in many other particulars from that of the female. The growth, usually situated near and below the nipple, is small, hard and freely movable in the early stages. Slow growth has been mentioned, and depending upon that, we find that adhesions

to the surrounding parts with fixation of the tumor are late manifestations. The growth, in spite of its long duration, remains small, usually being the size of a small nut, and occasionally becomes as large as an apple. Pain is rarely a prominent symptom unless extensive infiltration or ulceration has taken place. In many cases, the tumor, although of a fairly large size, produced no symptoms. The nipple becomes retracted in about half of the cases because the cancer is situated close to the ducts. In a few instances, the tumor has extended to and destroyed the nipple (Warfield). Discharge from the nipple is rather uncommon, but may be bloody, milky or puriform in character.

The majority of the above symptoms, therefore, represent late manifestations of the cancer, the disease having infiltrated the surrounding parts. At this stage, the diagnosis is not difficult, but it may be so in the early stages when the tumor is small and freely movable. That the primary tumor may be overlooked and serious consequences arise from its presence, is learned from McConnell's case. The man, aged fifty-four, developed symptoms which suggested a pulmonary lesion, and a diagnosis of sarcoma of the lung was made. The breast was enlarged, but the examination did not disclose any definite tumor, so that a neoplastic process was not suspected. The autopsy disclosed metastases in many of the viscera, including the pleura and lungs, the primary tumor originating in the breast.

The malignant degeneration of benign tumors will be alluded to. Sudden growth of a pre-existing tumor, with fixation of the mass, and especially if present in middle-aged men, should always warrant the diagnosis of malignancy and call for its appropriate treatment.

The histologic examination of the cases shows that the carcinoma arises most commonly from the ducts of the gland and less frequently from the acini, as is to be expected from their lack of development.

Williams's hundred cases were divided as follows: acinous 91 (scirrhus 88, encephaloid 3), tubular 6 (cylinder cell duct

cancer), cutaneous squamous cell cancer, 3. While the scirrhous variety is most commonly observed, the relative proportion is not so high in Warfield's series, 11 of 26 cases being scirrhous cancers.

A peculiarity of the histologic examination is noted in the number of melanotic and squamous carcinomas contained in Williams's collections. Of the scirrhous growths, two were melanomas; and one of the three squamous carcinomata was a melanotic tumor. This frequency is explained by the fact that skin growths, in general, are much more liable to affect the male sex. The melanotic tumors also arise much more frequently in connection with structures of integumentary origin. The male breast being of this type and having lost most of its special characters, is in a process of reversion to the primordial cutaneous condition, and herein may be an explanation of its comparative proneness to melanosis.

The recurrent disease is found usually in or near the scar of the operation, or it may arise in the axilla or opposite breast. It is worthy of note that the carcinoma was present, on an average, 20.4 months before operation was undertaken in five recurrent cases reported by Finsterer. The duration of life from onset of the tumor in these cases averaged 51.4 months, in spite of the secondary growths. On the other hand, in exceptional cases, the disease assumes a rapid growth, and its highly malignant character is manifested by recurrence a few months after operation. Manger states that 70 per cent. of the cases died of recurrence or metastasis, and that recurrence arose in 19 of 72 patients in a few months to 5 years. There were 9 recurrences within 6 months of the operation, 3 within 1 year, 2 within 2 years, 3 within 4 years, 1 within 5 years, 1 within 6 years. The tendency toward late recurrence 5, 10 or more years after operation, which is rather common in women, does not exist in men, the majority of the cases reported recurring within a comparatively short time, and a few living 5, 6 or 8 years before local recurrence arose.

Secondary growths involving the internal organs are most

commonly found in the liver and lungs. In 5 of 88 cases (Williams) deposits were noted in the bones; both clavicles and tibiæ, the vertebræ, the sphenoid and base of the skull were involved in one case each.

The operative mortality in Williams's statistics was 36 per cent., two deaths occurring in 56 amputations of the breast. Death in these cases was due to sepsis; this complication is practically unknown at the present day. The operative mortality at present is *nil*, the 34 cases collected by Warfield in recent times, and 30 I have reviewed, all recovered.

It is impossible to judge accurately concerning the percentage of cures because this fact is mentioned in a comparatively small number of cases. Finsterer was able to find but six cases in the literature in which it was stated definitely that recurrence had not arisen. Two of the cases in his series lived 21 and 11 years; Blodgett's case 5 years, and the second case reported by the author has lived 3 years without further trouble.

The following cases of carcinoma of the male breast are reported for the first time:

CASE I (Service of Dr. E. B. Hodge, Presbyterian Hospital).—Patient aged fifty-five, noted three months ago a small nodule below the breast. He states that when a boy the breast became red, painful, and swollen, and several times during adult life, similar attacks of inflammation occurred. At these times there was a slight discharge of clear fluid from the nipple. There was no history of trauma to account for the attacks. On examination, a hard nodule, the size of a hickory-nut, was found below the nipple, which was slightly retracted. The mass was adherent to the underlying tissues and was painless. The skin was atrophic in appearance and at a point over the tumor was brawny and infiltrated. One enlarged lymph-node was palpable. The tumor, when removed, was dense and stony hard, and showed microscopically a typical scirrhous carcinoma. The single enlarged lymph-node was not involved. There has been no recurrence nine months after operation.

CASE II (Service of Dr. C. H. Frazier, University Hospital).

—R. C., male, aged forty-eight, was admitted with the history of a recurrent tumor of the left breast. The growth appeared two years ago without cause and without pain, and seven months after it was first noted, the lump and nipple were excised. He remained well until a few months ago when a second nodule appeared and was excised. The histologic examination showed carcinoma in both instances, and the patient was finally persuaded to accept radical operation. The axilla contained several enlarged nodes which were removed, and, beneath the scar of the first operation, several nodules were found. These and the axillary lymph-nodes showed infiltration of a scirrhous type. No recurrence at the present time, three years after last operation.

SARCOMA.

Sarcoma of the female breast occurs in 1 to 2 per cent. of the cases, and as an affection of the male gland must be regarded as a very rare condition. In Schuchardt's statistics, only six cases are mentioned in which the diagnosis was confirmed by microscopic examination, and the three instances occurring in Williams's collection of 2422 tumors of the breast have been alluded to. In 1906, Finsterer found 12 sarcomas of the male breast in the literature, three of these he reported for the first time. Connell a year later reported a case occurring in a male aged twenty-five and thoroughly reviewed the subject, collecting, in all, 34 cases.

The clinical features of this form of malignancy resemble carcinoma in some particulars, and, in others, differ sufficiently to justify a diagnosis between the two. Finsterer has found the average age to be considerably lower than that of carcinoma—sarcoma 45.6 years, carcinoma 55 years. The following table represents the age incidence (Connell):

20 to 25 years	4 cases
30 to 35 years	3 cases
35 to 40 years	2 cases
40 to 45 years	3 cases
45 to 50 years	1 case
50 to 55 years	5 cases
55 to 60 years	1 case
73 years	1 case

The tumor begins as a small, freely movable nodule, which grows rapidly as a rule, reaching the maximum size within a year. Sarcomata in some cases may become as large as an orange or a child's head. The skin is involved in a comparatively small number of cases, therefore the formation of ulceration is seen much less frequently than in carcinoma. Fixation of the tumor to the underlying tissues is a rather late manifestation. Involvement of the axillary lymph-nodes, on the other hand, occurs frequently. In 20 cases Connell found axillary involvement mentioned 9 times; skin involvement 4 times; fixation to fascia 3, and no adherence 7.

While the tumors grow rapidly in the majority of cases, occasionally a period of several years elapses before they reach any considerable size, the average duration of the disease being much less than carcinoma. Family predisposition and traumatism play a less important rôle than they do in cancer, for Connell has found but two instances of the former and one of the latter.

Histologic examination has disclosed all varieties of sarcoma; the spindle-cell type, which predominates, is the least malignant. The varieties are subdivided as follows: spindle-cell 12, round cell 7, chloroma 1, cystic 3, and melanotic 3.

Some of the cases which have been reported should not be classified as breast tumors because they have originated in the skin, as pigmented moles or nævi. Sarcoma is reported to have developed from a nodule in the breast of 22 years' duration, and from other benign tumors most likely adenofibromata in nature.

The final result of the operative measures has been mentioned in comparatively few cases. Finsterer could record but one case of cure; in this there was no recurrence after 11 years. Connell mentions 11 recoveries. One case free for 2 years after the fourth operation; one recovery with development of keloid; recovery with development of erysipelas on second day, no recurrence after 11 years; one recovery with inoperable recurrence, after one year Coley's treatment, recovery. Deaths three; death after second operation within five months, one case.

BENIGN TUMORS.

Of the 25 tumors in the male breast, recorded by Williams, 16 were cancerous, 3 were sarcomatous and 6 were benign. Schuchardt's first collection included 274 malignant growths and 21 benign ones. Numerous reports of benign growths of the male breast point to the fact that the pathology of these conditions does not differ essentially from that of the female, and that the various tumor formations so common in the latter may find their counterpart in the male gland.

The least common benign tumors occurring in either the male or female breast are those composed of a single type of tissue. These cases are so rare that they are of most interest from a pathologic stand-point. The cases which have been reported by various authors include fibroma, myxoma, chondroma, angioma, adenoma, and myoma. Several instances of true lipomata presenting noteworthy features are on record. The tumors, for the most part, occur in middle-aged men, are soft, and occasionally reach a size to cause real discomfort. They are painless, of slow growth, and require several years to attain any considerable proportion. The lipoma observed by Queirel became as large as a child's head in 15 months, while in Masse's case the growth was congenital, and grew more rapidly, becoming the size of an orange in nine months. While the tumor in the last case occupied the mammary region, there is some doubt as to whether it and several other lipomata of congenital origin originated in the breast.

The most common tumor described is the fibro-adenoma, which Woodyatt divides into two groups:

(1) Sharply circumscribed form, dense tumors which arise without traumatism in the breasts of young men and run a painful clinical course. Microscopically, there is little or no evidence of inflammation, but all the characteristics of the fibro-epithelial tumors which occur in the breasts of young females, to which they are analogous.

(2) Diffuse or ill-defined growths which may occur at any age as the result of traumatism. Microscopically, these

enlargements have the same structure as those of the first group. Signs of inflammation are more in evidence, however, so that their differentiation from chronic inflammation may not be easy. They are called fibro-adenoma because of their progressive growth and microscopic structure. This formation corresponds to the "traumatic indurations" of some writers.

Fibro-adenomata of the male breast vary greatly in size. The tumors seen in boys in conjunction with inflammatory symptoms (adolescent mastitis) are usually small. Their growth is generally slow and progressive, several years elapsing until they reach the size of a walnut, an egg, or even an orange. In Whelan's case, the tumor began at the age of eighteen, and when removed, eight years later, weighed one-half pound. Rapid growth of the tumor may occur, as is seen in the instance recorded by Griffin which is of interest also because the growth was bilateral:

> The patient, aged forty-five, was struck seven weeks previously over the left breast, after which a tumor slowly grew until it reached the size of a hen's egg. Four weeks later a tumor in the opposite breast was removed; this growth was noticed one week after the first operation. Both tumors were fibro-adenomata on microscopic examination.

The interval between the appearance of the second tumor in the opposite breast is not always so short, as is indicated in Gangitano's case:

> A fifty-seven-year old man had a small tumor removed from the right breast sixteen years ago. During the past four years the left breast gradually increased in size, becoming denser than normal, painful on pressure but freely movable, and several enlarged axillary lymph-nodes developed. The breast was amputated, and microscopic examination showed a fibro-adenoma.
>
> A second instance reported by the same author occurred in a male aged sixty-six, in whom bilateral tumors developed over a period of seven or eight years, and reached the size of an apple in the right and a hazelnut in the left breast. The latter was removed and found to be an adeno-fibroma.

Many cases give the history of antecedent injury to the breast. This effect is mentioned by Denenholtz in a case of bilateral growth in a boy of fifteen years. It is doubtful if

traumatism plays an important predisposing rôle, as the injury is much more likely to call attention to a tumor already present in the breast, a fact commonly observed in growths in the female gland.

During the past few years considerable attention has been directed to the fact that all benign tumors of the breast are potentially malignant. In the female the possibility of carcinomatous degeneration is almost in direct proportion to the amount of epithelial hyperplasia in the primary tumor. We find, therefore, that the fibrous type of the fibro-epithelial tumors becomes malignant in a relatively small per cent.; and that the tumor formations with active proliferation in the ducts and acini undergo malignant change in as high as 24 per cent. of the cases. In other words, the adenofibromata rarely degenerate, whereas the cystadenomata and the cases of abnormal involution frequently become malignant.

It is to be expected, therefore, that tumors of the male breast should undergo similar degenerative changes, although the relative proportion should be less as the factors conducive to epithelial hyperplasia are not so active in the male. Carcinomatous formation in a pre-existing fibro-adenoma has been reported by Owens and Eisendrath.

The patient, aged fifty-six, noticed a slight depression of the nipple and a nodule, the size of a pea, in the right breast. The condition remained unchanged for 36 years, when a small scab formed on the nipple which would bleed slightly when the scab was removed. The nodule began to enlarge one year ago, and formed a hard tumor one inch in diameter, sharply circumscribed from the surrounding skin. The overlying skin was atrophic, bluish in color, and immovable. The microscopic examination. after extirpation of the tumor, showed a scirrhous carcinoma, which undoubtedly arose in the benign tumor described.

What relationship exists between adolescent mastitis and adenofibroma is not clear, although Woodyatt suggests that the former is a separate affection, as a sequel to which the adenofibroma may develop, for many of the cases of sharply circumscribed adenofibroma in youth have developed in the course of what appeared to be "adolescent mastitis." The following case which I observed for a period of three months seems to bear out this theory:

The patient, aged twelve, complained of pain and burning in the right breast, which, when examined, was slightly larger than the opposite one. The skin was red, but other evidences of inflammation were absent. The pain and swelling subsided under local treatment and the boy was discharged. He returned two months later, complaining of a lump in the breast, which, he said, was noticed several weeks after treatment was discontinued. The tumor was the size of a pea, hard, freely movable, tender on pressure, and situated below and to the outer side of the nipple. The growth was excised under local anæsthesia. The microscopic examination disclosed a fibro-epithelial tumor, in which the periductal fibrous tissue predominated. The ducts and acini were relatively few in number, and were lined with several layers of cuboidal epithelium. In a few acini more active hyperplasia caused the formation of solid plugs of cells, which were, however, non-invasive in character. Diagnosis: fibro-adenoma.

The above case illustrates the type of tumor occurring in Group I, and the following instance may be taken as an example of Group II:

Male (service of Dr. John B. Deaver, German Hospital), aged sixty-eight, noted a lump three months ago in the left breast. Little attention was paid to it until two months later, when it became slightly painful and enlarged progressively. The mass was situated under the nipple, and felt as large as a goose egg, but was not tender. No enlargement of axillary lymph-nodes was noted. The growth was excised. It was made up of fairly dense white tissue, which was not encapsulated as is the ordinary fibro-adenoma. Microscopically, a fibro-epithelial process was seen. The periductal tissue showed proliferation, was fairly cellular and contained many round cells. The acini were more numerous than normal, the lining cells were cylindrical and occurred in several layers. The degree of epithelial proliferation was excessive, but the cells did not extend into the periductal tissue. Slight dilatation of the ducts was seen, and in some of the cystic cavities, small papillæ were present. Diagnosis: adeno-fibroma.

The cystadenomata of the breast are not so common as the fibro-adenomata, although a number of cases have been re-

corded in the more recent literature. The line of demarcation between the cyst- and fibro-adenomata is not sharp in all cases, indeed it is contended by some that there are transition stages of one to the other. From the pathologic standpoint, however, it is of importance to make this distinction because the cystadenomata are more likely to carcinomatous degeneration, and from the clinical point of view they differ from the fibro-adenomata when cyst formation is prominent. The tumors are usually small and well circumscribed, but may become as large as an orange when cyst formation is extensive. The case recorded by Worbs caused considerable inconvenience on account of its large size, and for this symptom alone surgical intervention may be sought. The tumors are seen usually in men of advanced years, most of the cases occurring between the forty-fifth and sixtieth years of life, whereas the fibro-adenomata are frequent in youth. In Spencer's case the tumor was present since birth, enlarged rapidly when the boy was four years of age, and reached the size of an egg within three weeks. The breast when removed contained multiple cysts, the contents of which were bloody.

The cysts give to the tumors a definite fluctuation in some cases, and the fluid may be bloody, clear, or dark brown. Milky fluid was observed in a cyst occurring in a child eighteen months of age (Carpenter). The tumor was treated by aspiration, so that its true nature was not ascertained. In many instances papillary excrescences are present in the cysts, and these cases should be classified as papillary cystadenomata.

The following case represents an example of cystadenoma, the differentiation from fibro-adenoma being impossible clinically, as cyst formation was inconspicuous.

The patient, aged twenty-seven, noticed eight years ago a very small painless lump under the left nipple. It remained stationary until last year, when rapid enlargement took place. The patient attributes the growth to traumatism caused by boxing. The tumor, at the time of operation, which was performed by Dr. H. T. Harvey, was the size of a hen's egg, firm, movable,

with skin and nipple appearing normal, and on palpation was tender. The mass, when removed, was firm in consistency, white in color and contained small cysts scattered through the tissue. The cyst walls were smooth. Microscopic examination showed a dense fibrous stroma in which a few ducts and a large number of regular acini appeared. The epithelial cells were increased in number, forming a lining composed of several layers of cuboidal cells which were greatly compressed in the dilated acini. The cyst formation was seen in both the ducts and acini, and in many of the latter, minute papillæ projected into the lumen of the dilated spaces. Diagnosis: cystadenoma.

Cystadenomata may also undergo malignant degeneration as demonstrated by Peachell's report:

The man, fifty-eight years of age, had an abnormal development of both breasts, and in the left one, a tumor which began two years ago. The growth was small, irregular, soft, non-adherent to the skin or underlying tissues, and discharged a bloody fluid from the nipple. It was diagnosed a duct papilloma. A year later the growth presented a greatly altered picture: it was hard in consistency, adherent to the skin and pectoral fascia. The bloody discharge continued from the nipple, which became retracted. The breast was removed and the tumor found to be a scirrhus. The patient died of an intercurrent disease nine months later without recurrence or metastasis of the cancer.

CONCLUSIONS.

1. Carcinoma is the most frequent tumor of the male breast.

2. The disease is seen later in life, grows slower, ulceration is more common, and traumatism plays a more important rôle than in women.

3. The operative mortality is *nil;* but the percentage of cures is probably much lower than in the female.

4. Benign tumors are subject to the same malignant degenerations, as are similar tumors in the female.

5. Adenofibroma is the most frequent type of benign tumor encountered, although all varieties have been met with.

6. Adenofibroma in young men may be produced by the affection termed "adolescent mastitis."

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THE CLINICAL FEATURES AND TREATMENT OF ACUTE PERFORATING GASTRIC AND DUODENAL ULCER.

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ALTHOUGH the medical and pathological aspects of an ulcer occurring in the stomach or duodenum had long been recognized, it was commonly regarded as a fatal complication until scarcely thirty years ago, when Mikulicz made the first attempt to cure such a condition by surgical intervention. Although he was unsuccessful, yet the soundness of the principles which he had carried out was quickly recognized, and by following his example other surgeons have achieved considerable success and have brought the operation for the relief of perforation to a very high degree of perfection.

Notwithstanding this progress, perforations still frequently escape recognition or are mistaken for other lesions, and the resulting delay in the application of the proper treatment leads to the needless sacrifice of many lives. It is for this reason that the importance of the early recognition of a perforation by the internist has been frequently emphasized. He ordinarily is the first to see the patient, and it is by him that either the correct diagnosis must be made or the gravity of the symptoms recognized as indicating a condition which can be satisfactorily dealt with by the surgeon only.

In a paper read by invitation before the New Jersey State Medical Society in 1908 and subsequently published in the

journal of that association as well as in the *American Journal of Surgery* in October, November, December, 1908, and January, 1909,[30] the writer discussed with considerable detail the typical clinical features and treatment of this condition. It will, therefore, be unnecessary to indulge in needless repetition, although the importance of the subject warrants the mention of the more prominent symptoms in order that they may serve as a standard of comparison in speaking of the less frequent but equally important atypical variations of which they are capable.

Briefly, the perforation is usually preceded by a more or less well-defined history of gastric disturbance, which in many instances does not differ materially from that of a chronic dyspepsia; exceptionally the perforation may occur without the slightest premonition at any time of day or night in a patient who, up to that time, has enjoyed perfect health.

The onset of the perforation is marked by severe pain. This is undoubtedly the most constant subjective symptom. It is almost always knife-like in character, epigastric in its location, and is frequently borne by the patient only with the greatest difficulty. If it comes without warning the patient's task or occupation is suddenly interrupted, and if he is aroused from sleep any movement becomes difficult or impossible. The pain is usually increased by inspiration, by turning from one side to the other, by raising the body, unassisted by the elbows, to a sitting posture, and possibly by the flexion of one or both thighs. These different ways of eliciting or intensifying the pain, variable according to the location of the exudate and the direction of the spread of the peritonitis, are material aids in reaching an accurate diagnosis.

Vomiting, although by no means constant, is next to pain the most important subjective symptom. In Petrén's [102] series of 92 cases it was present in 43 cases of gastric and 10 cases of duodenal perforation. It was absent in 22 cases of gastric and 5 cases of duodenal perforation. The initial vomiting due to peritoneal irritation occurs probably in from one-

half to two-thirds of all cases of acute perforation shortly after the advent of the pain, and may recur with increasing frequency as the peritonitis becomes further advanced.

The character and the quantity of the vomitus depend upon the character and the quantity of the stomach contents at the time of perforation. It is a well-known fact that perforation may occur in stomachs quite empty, in which event the vomitus consists chiefly of bile and mucus; on the other hand, in stomachs more or less distended with food, the vomitus may be abundant, and consists of partially digested food. Blood in any considerable quantity is at all times a rare constituent.

Vomiting is more commonly observed in cases of duodenal than in those of gastric perforation, for in this latter condition the physiological act of vomiting is, of necessity, materially modified by the fact that even with but slight expulsive effort the gastric contents escape more easily downward through the perforation into the peritoneal cavity than upward through the œsophagus, whereas in perforation of the duodenum the stomach wall is intact and the mechanism of vomiting, in consequence, is undisturbed. In gastric perforation proper, the frequency of vomiting is thought by some to depend upon the facility with which the gastric contents can escape into the peritoneal cavity. Thus, Leroy and Minet and Durrgey,[72] with several other authors, state that in perforation near the cardia and lesser curvature vomiting is less frequent than where the perforation is nearer the pylorus or greater curvature. Based upon this theory is the treatment suggested by Patterson,[97] that in those cases in which through inaccessibility a perforation, usually near the cardia, defies either detection or satisfactory closure, an immediate posterior gastro-enterostomy provides for the rapid escape of the gastric contents into the jejunum, and thereby prevents, through over-flow, their passage into the general peritoneal cavity.

Before leaving the question of vomiting, the writer wishes

to call attention to the fact that in two cases herewith reported, this symptom was entirely absent. In Case XI the patient had had occasional attacks of vomiting prior to the perforation, while during the thirty-six hours between the perforation and operation, no vomiting whatever occurred. In Case X there was neither vomiting nor even the suggestion of nausea.

Shock, with its associated symptoms, is certainly the exception in both gastric and duodenal perforations. In many cases the pulse is scarcely increased in frequency during the first two or three hours after perforation, and in Case X reported by the writer the pulse was strong, of excellent tension, and but 48 in frequency seven hours after the perforation. If shock is present, it is at least so transitory in most instances that by the time of the first medical examination it has practically disappeared. It is essential to emphasize this fact, for the opposite view, frequently held by different authors, leads to erroneous diagnosis and to dangerous if not fatal delay in operation. For similar reasons it is well, in this connection, to emphasize the fact that shock, when present, is no contraindication to immediate operation. This statement is again at variance with the more or less widespread belief that under such circumstances operation should be deferred until the shock has subsided. Every hour of delay in diagnosis or of delay in operation after the diagnosis has been made decreases the chances of the patient's recovery.

The objective symptoms are most important. The character of the respiratory movement of different segments of the abdominal wall, the preponderance of thoracic over abdominal breathing, the presence of tenderness and especially of muscular resistance, together with the dulness in either the left or right flank, due to the exudate, have all been fully described in the paper already referred to. The writer is still of the opinion that muscular resistance is the most constant and most valuable objective symptom, and in its point of maximum intensity the most reliable guide to the site of the

lesion. Attention is again directed to the value of an increase in the resistance of the costal arch as an aid to diagnosis. In their escape the gastric or duodenal contents must of necessity pass downward through either the right or left lumbar gutter. The former in duodenal perforation is facilitated by the absence of the transverse colon which, in gastric perforation, inhibits for a time the passage of fluid into the left flank. In either event the resulting peritoneal irritation is reflected by an increase in the resistance of the lower segment of the corresponding costal arch which, in expiration, is less easily and less extensively displaced toward the vertebral column than on the non-affected side.

The disappearance of liver dulness is, still, in the writer's opinion, an exceptional and therefore unreliable symptom. In duodenal as well as in many cases of pyloric perforation, little if any gas passes into the peritoneal cavity. The same is true of gastric perforations at a distance from the pylorus in which perforation occurs when the stomach is empty. It is chiefly in perforations occurring shortly after eating, at a time of gastric fermentation, and in a zone of the stomach more or less remote from the pylorus that gas may be expected to escape in sufficient quantity to modify the normal liver dulness. Petrén [102] observed gas on opening the peritoneal cavity in about one-third of his cases of gastric perforation and in only two of 18 duodenal perforations. In a note he states that observations in regard to the disappearance of liver dulness were not made with sufficient frequency to be of any value. In a number of these cases, however, the gas was in such small quantities that it could have had no appreciable effect on the normal area of liver dulness.

Dulness in either flank is unquestionably a symptom of great value. Small amounts of fluid in this location can, in the writer's experience, be readily detected with the aid of auscultation. In the hands of others, auscultation does not always seem to render the same assistance in eliciting this symptom. It is well in this connection to call attention to the

symptom described by Shoemaker,[105] in which a dull percussion note over fluid in the flank gradually assumes a tympanitic quality when by an increase in pressure of the percussed finger against the abdominal wall, the fluid is displaced and the intestine brought into closer proximity.

The frequency with which cases of acute perforation fail to be recognized and the consequent unnecessary prolongation of an operation in which the utmost speed is essential by the making of one or more exploratory incisions at a point distant from the lesion certainly justify a brief consideration at least of their differential diagnosis.

Although conditions with which acute perforation might be confused should theoretically be limited to lesions in the right upper quadrant or at least to lesions in the epigastric region, yet as a matter of fact it is more frequently confused with an acute appendicitis than with any other condition. Both are frequently preceded by a history of gastric symptoms of variable intensity and degree; in both the onset of the attack is usually marked by severe pain with or without vomiting, the elevation of both pulse and temperature, and a definite leucocytosis. They are generally to be distinguished by the fact that in gastroduodenal perforation the onset of the pain is sudden, while its location is more definitely epigastric. In appendix the pain, at first referred to the region of the navel, is ordinarily reflected within a few hours to the right lower quadrant. This rule, however, has many exceptions. In the early hours after the onset of either lesion the diagnosis should be easily made by the difference in the physical signs; while in perforation the tenderness and rigidity are most marked above the level of the navel to the right (duodenal or pyloric) or to the left of the median line (cardia), according to its location, in acute appendicitis the tenderness and rigidity are most marked in the right lower quadrant. In perforation the dulness is elicited in either the right or left loin, while in appendicitis it is more tardy in its appearance and is located at first between the anterior superior spine and the umbilicus.

After the first 12 to 24 hours the physical signs more closely resemble each other if the perforation is in the vicinity or below the level of the pylorus, for by this time, or even earlier, the contents of the stomach or duodenum have passed through the perforation down through the right lumbar gutter into the pelvis, and the resulting rigidity and tenderness referred to the lower part of the abdomen may be more intense than the rigidity at first elicited over the site of the perforation. With advancing and general peritonitis, the differential diagnosis becomes increasingly difficult and sometimes impossible without the aid of an exploratory incision.

In case of error the correct diagnosis is readily made as soon as the abdominal cavity is opened, by noting the actual gross pathological condition. If the appendix is exposed by the McBurney incision, the prolongation of the operation is almost *nil,* for, by this route, the peritoneal cavity can be opened in less than a minute and the opening subsequently used for pelvic drainage. The difference in the gross pathology of perforation and acute appendicitis was fully described by the writer in his previous paper,[30] and the importance of the subject seems to warrant its repetition at this time.

The fact that acute gastric and especially acute duodenal perforation is frequently mistaken for acute appendicitis warrants a brief statement of the chief gross pathological differences of these two conditions when, under the impression that an acute inflammation of the appendix exists, the right lower quadrant of the abdomen is opened. In both, fluid usually escapes when the peritoneum is divided. In gastric or duodenal perforation, this fluid is yellow, usually free from odor, and is distributed uniformly and without change of color, odor, or consistency around the cæcum and between the intestinal loops that lie in the pelvis. It is usually more abundant as the upper part of the ascending colon is exposed. The change in the appendix is limited to its peritoneal coat which, like the serous investment of the adjacent intestine, may be

reddened and injected. In a severe acute appendicitis, on the other hand, the fluid near the parietal peritoneum is usually serous. It is relatively small in quantity and free from odor. As the appendix is approached, however, the fluid rapidly becomes turbid, and finally the appendix, discolored and friable, is usually found surrounded by thick offensive pus which may be in whole or in part shut off by adhesions from the general peritoneal cavity. In the absence of such characteristic changes both in and around the appendix, the source of an incipient general peritonitis of dubious origin most probably lies in a perforation of the stomach or duodenum, and the exposure and thorough search of these two structures should follow immediately.

The lesions in the upper right quadrant for which acute perforation may be mistaken include those of the gall-bladder, the pancreas, and the appendix. The rare cases of appendix in this region include those in which the cæcum is undescended, the appendix, in consequence, being out of its normal position, and those equally rare cases in which the tip of an unusually long retrocæcal or paracæcal appendix lies in proximity to the liver or gall-bladder and in this situation becomes gangrenous.

Severe acute cholecystitis, especially of the gangrenous type, with or without perforation, may simulate acute perforation at or near the pylorus so closely as to render differential diagnosis well nigh impossible. Both subjective and objective symptoms differ in degree. Both have in common a sudden onset, severe pain intensified by respiration, vomiting, constitutional disturbance, and prostration. In perforation the pain is usually nearer the mid-line than in acute cholecystitis, although exceptions to this rule are numerous. In both there are tenderness and rigidity over the upper part of the right rectus and the right costal arch. In cholecystitis, if the gall-bladder lies beneath the costal border, tenderness may be elicited by pressure on the junction of the eighth and ninth costal cartilages; in perforation, tenderness is referred by the

patient to a position nearer the mid-line in the epigastrium. In perforation, the rigidity is more intense and involves a wider area than is generally the case in cholecystitis. In several instances of perforation, herewith reported, the dulness extended from the loin to the outer margin of the rectus muscle; in cholecystitis the fluid is much smaller in amount and the dulness is obtained over a correspondingly smaller area.

On opening the abdomen, the correct diagnosis is obvious. Fortunately a right pararectal incision, enlarged if necessary by a second incision extending from its upper extremity inward to the median line, exposes the gall-bladder, the duodenum, and the pyloric end of the stomach, and serves equally well for the detection of an enlarged, swollen, tense, and discolored gall-bladder on the one hand or for a pyloric duodenal perforation on the other. Through this same incision the appropriate treatment of either condition can easily be carried out.

The differential diagnosis between perforating ulcer and acute pancreatitis may be much more difficult than between perforation and either appendicitis or cholecystitis. In the latter conditions, difficulty is experienced only when the perforation is either at the pylorus or its immediate vicinity, for in that event the symptoms are most pronounced on the right side. If, on the other hand, the perforation is in the middle of the stomach or between this point and its cardiac extremity, the symptoms are referred either to the mid-line or to the left of the mid-line, and the resulting exudate together with the contents of the stomach give dulness in the left loin. Both subjectively and objectively, therefore, the symptoms of acute perforation near the cardia can simulate those of an acute appendicitis or cholecystitis only when the appendix or the gall-bladder lie to the left of the median line—an improbable though not impossible location. On the other hand the pancreas, like the stomach, extends to either side of the median line. It is obvious, therefore, that an acute pancreatitis, in-

volving the head of that organ, will result in objective and subjective symptoms which are referred to the right upper quadrant, while in similar involvement of its tail the symptoms are referred to the left upper quadrant and to the left loin. In the former event the symptoms may be almost identical with those of a duodenal perforation and in the latter case to those of a perforation near the cardia. The two conditions are to be distinguished mainly by the detection of some disturbance of the pancreatic digestive function. At the time of operation, however, a correct diagnosis is usually not difficult. Again, as in cholecystitis, a pararectal incision gives convenient access to the head of the pancreas. On opening the peritoneal cavity abundant free fluid is found, which in pancreatitis is dark-colored if not actually blood-stained, while in duodenal perforation the fluid is acid in reaction, not infrequently mixed with gas, and contains a certain amount of stomach contents. The occurrence of small patches of fat necrosis in the overlying omentum is extremely suggestive of pancreatitis. Inspection and palpation of the stomach shows that organ normal and probably in a distended condition, while on deeper palpation the head of the pancreas is felt to be swollen, elastic, and enlarged.

Errors in the diagnosis of acute perforation of the stomach are not confined to lesions of the appendix, gall-bladder, or pancreas, but include other conditions as well. The occasional obstipation, together with vomiting, may suggest intestinal obstruction. In Case XI herewith reported, even in the total absence of vomiting for 36 hours subsequent to the perforation, this diagnosis was made by two surgeons in view of the marked obstipation and also in view of the fact that, owing to the spread of the peritonitis, the physical signs in the left lower quadrant were as marked as those in the upper right part of the abdomen. Mention is also made in the published reports of cases by different observers of operation for supposed ectopic gestation and even for renal calculus.

The consideration of the differential diagnosis of perforating ulcer could not be passed over without emphasizing one final important point that, no matter what the condition which may simulate a perforation, immediate operation is just as necessary and delay may be just as dangerous as if a perforation actually existed. In other words, that any lesion of which the subjective and objective symptoms simulate perforation should be immediately referred to the surgeon, and that delay for any reason can only be prejudicial to the patient's interest and is therefore entirely unjustifiable.

A knowledge of the essential gross pathological features of perforating gastric and duodenal ulcer facilitates their rapid discovery when the abdominal cavity is opened. The perforation is most frequently located on the anterior wall at or near the pylorus. From this point perforations are found with diminishing frequency along the lesser curvature toward the cardiac end of the stomach. They are much less commonly found at or near the greater curvature or on the posterior wall of the stomach. (The writer has never found a perforation in this last mentioned situation.)

Ulcers in which perforation may occur are single or multiple; in the latter event ulcers may be found simultaneously in the stomach and duodenum. The coexistence of ulcers is not uncommon. F. Brunner [16] estimates that in from one-quarter to one-third of all cases multiple ulcers are present. On the other hand, multiple perforations are rare. The writer, in his previous paper,[30] collected 18 cases of this character, and to this number must now be added four others reported by Petrén [102] in his series of 92 cases and four more reported by Villard and Danatello [114] in a series of 115 cases. In the same paper the writer also called attention to the fact that in many instances perforations occurred simultaneously at corresponding points on the anterior and posterior walls of the stomach; in other cases the perforations were situated either close together or were separated by a considerable interval on the same side of the stomach. In almost every

instance of multiple perforation, the second perforation was not found at the time of operation and was discovered only at the subsequent autopsy. The ease with which multiple perforations are overlooked emphasizes the necessity of a rapid but careful search of both sides of the stomach before the abdominal wall is closed; while the anterior wall may be quickly inspected, the posterior wall can be adequately searched only after opening the lesser peritoneal cavity either through the gastrohepatic omentum, the gastrocolic ligament or the transverse mesocolon. If perforation exist, the lesser cavity will contain gas, stomach contents, or exudate in varying amounts.

A secondary perforation in a coexisting ulcer may take place several days, weeks, or even months after the primary perforation has occurred. It is to prevent this accident that a gastro-enterostomy has been advocated, but even the addition of this measure has not always accomplished this purpose.

The writer wishes also to call attention to the fact that the orifice of a small perforation may become temporarily closed through a plug of fibrin and the escape of the gastric contents delayed until the plug is dislodged. In one of Schoemaker's [105] successful cases, operated on six days after the perforation had taken place, the perforation was closed in this way and the peritonitis was still circumscribed. Another fact of interest is that in perforations of the posterior wall of the stomach the peritonitis may be confined through the fortunate prior obliteration of the foramen of Winslow (not an uncommon condition in gastroduodenal ulcer) to the lesser cavity. In another of Schoemaker's [105] recoveries this condition was found in a patient operated on three days after the perforation had occurred.

The treatment of perforation is exclusively surgical, and consists in the closure of the perforation with or without a partial or complete excision of the ulcer proper. Complete excision is of value in small perforating ulcers in any acces-

sible portion of the stomach or duodenum, when the resulting gap can be easily closed without undue tension. Excision is of special value if closure of the perforation by suture is impossible because of the friability of the tissue through which the sutures must pass. On the other hand the closure of gaps after excision of large ulcers may be difficult, and the lumen of the viscus, especially in the pyloric and duodenal zones, unduly narrowed. In cases of this character, as a substitute for excision the perforation can be closed satisfactorily by the superposition of an adjacent viscus, preferably of the gall-bladder as has been done by Bessel-Hagen [9a] and Downes,[29] or by the apposition and suture of an omental flap over the weakened area, as has been done by Braun [13] and Gibbon. The plugging of the orifice of the perforation with omentum has been followed in several instances by its necrosis and secondary perforation. As a last resort, perforations, which cannot be effectively sutured or closed in one of the ways above described, can be treated by the insertion of a tampon to the point of perforation or by the establishment of a temporary gastric or duodenal fistula according to the method of Axhausen [5] or Neumann,[92] in which a rubber catheter first inserted through the perforation is subsequently surrounded by a funnel of omentum, forming a channel through which the contents of the duodenum may escape or food be introduced without incurring the risk of invasion of the general peritoneal cavity. Perforations which cannot be found may be treated by tampon or by a gastro-enterostomy, to which reference has already been made. F. Brunner [16] collected 15 cases in which the perforation was treated by the insertion of a tampon, with only three deaths. In the majority of these cases a gastric fistula formed which subsequently closed spontaneously. On the other hand, in Petrén's [102] much more valuable table of 92 cases, only three of 39 cases treated by tampon recovered, against 28 of 61 treated by suture which recovered, a result which leads Petrén to emphasize the undesirability of this method of treatment.

In regard to the excision of a perforating ulcer, the argument has been advanced that by this method the ulcer is definitely removed and therefore the risk of a recurrence of a perforation or of subsequent hemorrhage made impossible. It is necessary, however, to remember that excision of a perforation can in no way influence the course of a coexisting ulcer nor prevent either perforation or hemorrhage from taking place at such a point. As a matter of fact, simple suture of a perforation seems to be followed by as complete a cure of the affected ulcer as is accomplished by its excision. Evidence to demonstrate this fact is furnished by the interesting cases of Morton,[90] Fenwick,[34] and Marnoch.[74] Morton reports a case of the suture of a pyloric perforation 49 hours after it had occurred. There was general peritonitis at the time of operation. The patient died three months after from a complicating subphrenic abscess and an autopsy showed that the site of the sutured ulcer was marked by a scar and that a second perforation, shut off from the general cavity by adhesions, had taken place in a coexisting ulcer. Fenwick reports a death from general peritonitis 15 days after the suture of a perforation. Autopsy showed the ulcer to have entirely healed. Marnoch[74] lost a case of perforation from pyæmia nine weeks after it had been closed by suture. The autopsy showed no trace whatever of the ulcer. Steinthal[108] also reports a case in which three months after the suture of a perforation plus gastro-enterostomy, the patient died from a subphrenic abscess. The autopsy showed that the ulcer had entirely healed. Moreover, in perforations treated by suture, subsequent perforation or hemorrhage, rare as it is, does not usually take place at the point of suture, but from some coexisting ulcer. Finally, it must be remembered that excision can in no way remove the cause of ulceration whatever that may be, and that after successful excision, through the formation of new ulcers the patient may again be subjected to the risk of perforation, hemorrhage, or any other serious complication.

Whether the particular method of suture contributes in any way to the ultimate healing of an ulcer in which the perforation has been merely closed cannot be definitely stated, but it is quite conceivable that the purse-string suture, although it does not completely penetrate the wall of the stomach, may modify the circulation of the included segment to such an extent as to replace the ulcer with a healthy granulating surface which quickly heals, while the security of the sutured area is insured by one or more reinforcing Lemberts.

After the closure of the perforation, the adjacent part of the peritoneal cavity should be carefully cleaned. This can be done either by dry sponging or by local irrigation, the writer preferring the latter method. In no event should evisceration be practised. In cases of general peritonitis, the cleansing of the abdomen with abundant warm saline solution seems to be most efficient. It is of the utmost importance, especially in a condition of advanced peritonitis, that the entire period of anæsthesia should be curtailed as much as possible, and accordingly the cleansing of the abdomen should in these cases be rapid rather than complete. In this connection it is well to remember that the virulency of the infectious exudate, greatest near the point of perforation, rapidly decreases as the more remote parts of the peritoneal cavity are reached. It is, therefore, essential to cleanse with the greatest care the region of the stomach and the contiguous subphrenic spaces into which, almost from the very start, stomach contents have gravitated, while less attention may be devoted to the cleansing of that part of the peritoneal cavity below the level of the transverse colon. Subsequent drainage is essential only in those cases in which it is impossible to secure adequate cleanliness. The facility with which this may be accomplished depends upon the interval between the time of perforation and that of the operation, as well as upon the character of the exudate and the quantity of stomach contents which it contains. Usually, within the first six to eight hours after perforation, the peritoneum can be so thoroughly

cleaned that drainage is unnecessary. In the later cases, drainage is essential, especially of the subphrenic spaces. Apart from the immediate and frequently unavoidable peritonitis, no post-operative complication is more frequent or fatal than that of subphrenic abscess. Federmann [32] cites three deaths out of a total of seven from this cause. Of F. Brunner's [16] tabulated list of 470 cases, there were about 280 deaths, and of these 16 gastric and 1 duodenal perforation died from this complication, while in the 92 consecutive cases reported by Petrén [102] no less than 6 of 69 fatalities were due to this cause.

As a matter of fact, the drainage of the subphrenic spaces is more difficult than that of any other part of the peritoneal cavity. Below the level of the transverse colon, drainage is unquestionably facilitated by the movement of the intestine and by the favorable action of the intra-abdominal pressure. Even of the pelvis satisfactory drainage can be provided through the suprapubic route without resorting to a counter-opening in the rectum or vagina. On the other hand, above the transverse colon and especially above the level of the stomach, the absence of the small intestine and the modified abdominal pressure, together with the fact that the subphrenic spaces are bounded in part by more or less rigid walls, make the satisfactory drainage of these spaces a very difficult matter. To drain them against gravity is practically impossible, and it is only by the elimination of this factor that drainage becomes possible. This fact is abundantly proved by clinical experience and may be still further substantiated by laboratory demonstration. The best method of draining the subdiaphragmatic spaces is either one in which, by placing the patient in a suitable position, any infectious exudate or purulent material which they contain will flow toward the lower part of the peritoneal cavity and out through the abdominal incision, or by making a counteropening in the most dependent part of the affected space itself. The first method of drainage may be effected by placing the patient

in the "Fowler" position, but this sometimes fails to secure the desired result, especially in corpulent subjects as well as in those patients who, on account of great weakness, find it difficult to maintain the position for any considerable length of time. Of greater value than the Fowler position in maintaining effective drainage of the subdiaphragmatic spaces is the simple prone position. This, however, is extremely uncomfortable to the patient and cannot be assumed for any length of time without material discomfort. To obviate this objection, the writer is at present interested in the designing of a suitable bed or apparatus in which the prone position may be indefinitely maintained without complaint from the patient. If necessary, effective drainage can usually be secured by making a counteropening through the lower posterior pleural space. This operation in a patient necessarily in a weakened condition may not safely be tolerated and should therefore be done only after all other means fail. Under such conditions the operation, if successful, yields satisfactory results.

In order to determine the relative value of drains themselves experiments have been recently made in the laboratory of the hospital by my assistant, Dr. Jameson, with the following results:

1. Gauze and cigarette drains will drain only thin fluids.

2. Very tightly rolled gauze drains are not quite as good as those more loosely rolled.

3. Gauze and cigarette drains will drain the fluid from pus but none of the solid material even with the assistance of gravity or suction.

4. Lampwicks are of no value as drains.

5. The most efficient drain is a soft rubber tube with a gauze strip inside. The gauze should not fill the entire lumen.

6. Any form of suction attached to a drain improves its efficiency.

In Case XI herewith reported the drainage of both subdiaphragmatic spaces was satisfactorily accomplished with the patient in the supine position by attaching a siphon drainage

apparatus to the end of two rubber tubes which passed down a distance of six and eight inches, respectively, through the epigastric incision into the right and left loin.

After the necessary cleansing and drainage of the peritoneal cavity, the question of adding a gastro-enterostomy to the measures undertaken for the closure of the perforation is one of vital interest and importance.

In the first place, there is a group of cases in which a gastro-enterostomy is urgent, namely, in those in which the closure of the perforation, in whatever way it has been accomplished, results in such a constriction of the pylorus or duodenum as to interfere with the passage of the gastric contents into the intestine. The writer is convinced, however, that such a contingency is very unusual and that in many cases in which a gastro-enterostomy has been done on that account, the food would have had very little difficulty in passing beyond the point of supposed constriction had the gastro-enterostomy been omitted. It must be remembered that the gastric contents pass through the pylorus and duodenum in a fluid condition, and that this is especially the case when, after gastric operations, the diet is naturally restricted for some time to fluids only. If the perforation involved an ulcer of recent formation without the encroachment of previous cicatricial tissue on the lumen of the pylorus or duodenum, it is safe to infer that any perforation could be closed by suture without the danger of subsequent constriction. Even in perforations of large size in indurated ulcers, successful closure has been accomplished without gastro-enterostomy. Thus Jopson [53] reports the successful suture of a ragged pyloric perforation admitting the gloved index-finger in the centre of an area of induration, the patient being quite well two years afterward. On the other hand, the closure of a perforation in an old callus ulcer, which in itself has led to considerable previous cicatricial contraction, may so diminish the lumen of the viscus as to make a gastro-enterostomy necessary. The writer recalls one instance, however, in which, after a history of more than

20 years, a greatly emaciated patient (and yet not complaining of the subjective symptoms of starvation) was admitted to the hospital with a diagnosis of carcinoma. Subsequent examination showed a condition of chronic ulceration of the pyloric and duodenal junction with cicatricial stenosis so advanced that for a distance of at least one inch the lumen of the intestine was only sufficiently large to admit a lead-pencil. This advanced lesion had been of slow formation, and it is quite conceivable that, had it been of more rapid development, acute obstruction would have ensued. That such extreme stenosis does not necessarily interfere with the passage of gastric contents into the intestine in quantity sufficient to maintain life, is certainly worthy of comment. In this connection it is of interest to note how great a degree of constriction of the first part of the duodenum can be produced without primarily interfering with the passage of food or secondarily leading to compensatory hypertrophy, with or without dilatation, of the stomach.

In order to investigate this question, nine cats were operated upon, of which one died of peritonitis caused by leakage and two others from diseases not connected with the digestive tract. In the remaining six the method employed was to excise from one-quarter to two-thirds of the circumference of the duodenum, suture the gap, and allow the cats to live six months.

Following the operation, all the cats showed progressive improvement and gain in weight, variations being directly traceable to external influences. Two cats vomited on the day after operation, and one other refused most of its food for a week.

At the end of six months examination of the removed specimens showed a negligible enlargement of those stomachs where two-thirds of the circumference of the duodenum had been removed. The duodenum showed only a slight constriction at most, and in those cases where small amounts were excised none whatever. Some difficulty was experienced in locating the spot where the excision had been made because of the comparatively normal appearance of the duodenum. There was in some cases a puckering of the mucosa and slight induration at the site of the scar. Microscopically, examination revealed in two cases complete regeneration of epithelium and in a third a covering of degenerated epithelium.

Conclusions: It is not possible in the cat by partial excision of the wall of the duodenum to produce a permanent marked constriction of its lumen or a resulting dilatation of the stomach.

In the cat the duodenal wall is so thick as compared with the diameter of the bowel that after removal of two-thirds of the circumference of the duodenum so little mucous membrane remained that suture of the edges of the opening was extremely difficult. Notwithstanding this immediate constriction produced by the operation, the wall subsequently stretched sufficiently to make the diameter of the duodenum practically uniform.

Doctor W. G. MacCallum (personal communication), in attempting to produce partial pyloric obstruction in dogs has had a similar experience.

Subject	Weight at operation	Amount removed	Weight after six months	Degree of dilatation of stomach	Degree of constriction of duodenum	Appearance of site of excision	Microscopical examination
	Gm.		Gm.				
1	2720	⅔	3900	Very slight	Very slight	Induration puckering	Covering of degenerated epithelium.
2	2050	½	3020	0	0	Negative	
3	2280	½	3350	0	Very slight	Negative	Normal.
4	1900	⅔	2250	Slight	Slight	Groove in mucosa	
5	2420	½	3400	0	Very slight	Induration puckering	Normal.
6	2830	⅔	3680	0	Slight	Induration	

All the cats were in poor condition when received.

A second group includes those desperate or neglected cases in which there is an advanced peritonitis at the time of operation. The most enthusiastic champion of gastro-enterostomy after closure of a perforation would unquestionably concede the propriety of its omission under such circumstances.

A third group includes all cases in a favorable condition in which closure has been accomplished without undue constriction and in which there is no advanced peritonitis. The adherents of a gastro-enterostomy in cases of this character advance the following arguments for its performance. They believe that it is of immediate benefit in that it (*a*) prevents undue tension on the closed perforation and thereby obviates the danger of the yielding of the suture; (*b*) that it diminishes the danger of perforation in coexisting ulcers; (*c*) that it diminishes the risk of hemorrhage from coexisting ulcers; (*d*) that it increases the probability of the healing of

coexisting ulcers; (*e*) that it favors the early and prompt post-operative nutrition of the patient; (*f*) that it may prevent the further escape of gastric contents from a perforation which cannot be located, by providing means of their rapid and direct passage into the intestine.

They further assert that its benefit is lasting and permanent in that (*a*) it prevents the remote perforation of coexisting ulcers; (*b*) that it forestalls the effect of cicatricial contraction and the consequent stasis of food. In other words, that it has the same beneficial effect as a gastro-enterostomy which is done in the absence of a perforation.

On the other hand, the arguments advanced by many observers against a gastro-enterostomy may be grouped as follows: (*a*) it prolongs an operation which is one of emergency and which it is always desirable to conclude in the shortest possible time; (*b*) that it subjects the patient to the added risk of infection of the lesser peritoneal cavity; (*c*) that patients in whom a gastro-enterostomy is done are not always relieved of their gastric symptoms; (*d*) that patients treated by suture only frequently suffer from no recurrence of their symptoms; (*e*) that in those cases of perforation treated by suture only, in which the symptoms of gastric ulcer either persist or recur, a gastro-enterostomy can be done more safely than at the time of perforation; (*f*) that patients in whom a gastro-enterostomy is added to the closure of a perforation are subjected to the risk of a subsequent peptic ulcer in the jejunum.

These different arguments in favor of and against a gastro-enterostomy are worthy of most careful consideration.

In regard to the possibility of the yielding of the suture in those cases where a gastro-enterostomy is omitted, it may be said that, theoretically, the occurrence of more or less powerful muscular contraction in a moderately distended stomach ought to result in the tearing out of the suture and the recurrence of the perforation. As a matter of fact, however, experience shows that this accident rarely if ever occurs, and

in those patients who die from peritonitis or other cause the autopsy frequently records the fact that the sutures closing the perforation are intact. Thus in Brunner's [16] extensive statistics no mention of the giving way of a sutured perforation occurs, although he refers to 12 cases in which a fatal issue resulted from the perforation of a coexisting ulcer on an average of eight days after the original perforation had been closed. Furthermore, a search of Petrén's [102] histories shows 13 instances in which in the autopsy findings the definite statement is made that the sutures had held, while in only one the sutures are reported to have given way. In this instance the original perforation had been found after considerable difficulty on the posterior surface of the stomach near the cardia and the orifice "was closed as well as possible." Evidently the perforation had proved relatively inaccessible and its closure correspondingly defective. The giving way of the sutures has never taken place in the writer's experience, and if closure of the perforation is made with a purse-string suture reinforced by at least two Lemberts the writer believes it is unlikely to occur. If the security of the suture is endangered through the friability of the adjacent tissue, it can readily be strengthened by the superposition of an omental flap, a procedure otherwise unnecessary and having the disadvantage of predisposing to secondary ileus.

Gastro-enterostomy probably diminishes the danger of the perforation of coexisting ulcers by facilitating the passage of the gastric contents into the intestine. F. Brunner [16] mentions 12 perforations of this character occurring within one month after the suture of the primary perforation. On the other hand, the fact that an added gastro-enterostomy does not necessarily protect against perforation is demonstrated by the cases reported by Schoemaker [105] and Dahlgren [24] (two cases). Furthermore, it is a well-known fact that perforation may occur in stomachs shortly after a previous gastro-enterostomy for ulcer, either at the point of anastomosis or in some remote portion. Thirteen instances of such perforation, collected from

the literature, including those reported by the writer in his previous paper, are reported below.

That a gastro-enterostomy added to the closure of a perforation diminishes the probability of subsequent hemorrhage from coexisting ulcers is quite untenable. F. Brunner [16] reports eight cases of this character after the closure of perforation by suture and to this number must be added one reported by Wallis,[117] one by Heussler,[45] and three by Petrén.[102] On the other hand, three instances of this accident occurring in cases in which simultaneous gastro-enterostomy was done, reported by Steinthal,[108] Mühsam,[86] and Dahlgren,[24] may be cited.

Additional testimony adverse to the efficacy of gastro-enterostomy in protecting patients against this accident is furnished by the experience of Krogius,[59] Küttner,[63] and Albrecht.[124] Krogius reports three cases in one of which secondary hemorrhage occurred six days after a posterior gastro-enterostomy and two cases in which this accident was fatal one day and three weeks respectively after an anterior gastro-enterostomy with entero-anastomosis. Küttner reports two cases in which a fatal hemorrhage occurred one day and three weeks respectively after a gastro-enterostomy, of which the type is not mentioned. Albrecht also reports two cases in which hemorrhage led to a fatal issue two and three days after an anterior gastro-enterostomy with entero-anastomosis and a posterior gastro-enterostomy respectively.

That a simultaneous gastro-enterostomy increases the rapidity with which coexisting ulcers heal is necessarily conjectural. Although it is quite probable that the healing of coexisting ulcers in the pyloric and duodenal zones is thereby hastened, other ulcers between the gastro-enterostomy orifice and the cardia could be favorably affected only through the diminution or prevention of hyperacidity.

That simultaneous gastro-enterostomy permits earlier feeding of the patient than in those cases in which the perforation is merely closed would not be granted by many observers.

In the early days of gastro-enterostomy, the question of post-operative feeding was approached with fear and trembling. At present the general custom is to give small quantities of food by mouth as early as 15 to 20 hours after operation, and, if tolerated, this amount is rapidly increased. The writer has adopted a precisely similar method of feeding in cases of perforation and has never seen an accident after its use. Only in those cases in which the stability of the sutured perforation may be insecure through tissue friability is special caution necessary, and as has already been mentioned, even then the sutures are not likely to give way. To show the time at which the post-operative feeding is begun the writer has taken the following extracts from the histories of the cases reported in his previous paper and those reported now for the first time:

CASE 1: Perforation anterior wall three inches from the cardia; 1903. Albumin, water, and kumyss at the forty-eighth hour.

CASE 2: 1904; perforation on the anterior surface of the pylorus. Peptonized milk on the fourth day.

CASE 3: 1905; duodenal perforation. Water and kumyss three and one-half days after perforation.

CASES 4 and 5: No record.

CASE 6: 1907; duodenal perforation. Full fluids the twenty-fourth hour.

CASE 7: 1907; duodenal perforation. Water, broth, and beef tea at the thirty-sixth hour.

CASE 8: 1908; duodenal perforation. Sips of water sixteenth hour. Fluids without milk thirty-sixth hour.

CASE 9: 1910; pyloric perforation. Small quantity of water fourteenth hour; Lenhartz diet thirty-sixth hour.

CASE 10: 1910; pyloric perforation. Ice and water fourteenth hour. Lenhartz diet sixtieth hour.

CASE 11: 1911; pyloric perforation. Hot water fourteenth hour. Milk and brandy thirty-eighth hour.

CASE 12: 1911; gastric perforation near pylorus; treated as in Case 11.

A careful consideration and analysis of the preceding facts seem to indicate that, on the whole, the immediate advantages of supplementing the suture of a perforation with a gastro-enterostomy are at best but very slight and not at all likely to contribute materially to the patient's recovery.

(To be continued.)

THE REPAIR OF HERNIÆ FROM THE PERITONEAL SIDE OF THE ABDOMINAL WALL.

BY E. H. BECKMAN, M.D.,

OF ROCHESTER, MINNESOTA,

Assistant Surgeon to St. Mary's Hospital.

It often becomes necessary to operate for abdominal conditions upon patients who also have either femoral, inguinal or umbilical herniæ. For a number of years in such cases it has been the practice in St. Mary's Hospital (Mayo Clinic) to repair these herniæ from within the abdomen, provided they are not of enormous size. The operation was first used in repairing femoral herniæ, and is similar to the Ochsner operation for this condition. The following is a description of the technic in a case of femoral hernia.

After the primary operation has been completed, the abdominal wall is retracted on the side of the hernia so that the femoral ring is exposed. A pair of artery forceps are then introduced through the hernial ring from within the abdomen to the bottom of the sac. The sac is grasped with these forceps and pulled back into the abdomen. Two or three mattress sutures of heavy linen or silk are then passed completely through the neck of the sac and tied. The remaining portion of the sac can then be either excised or stitched to the abdominal wall.

The most essential factor in the cure of a hernia is to obliterate the sac, and it will be seen that, following this operation, the sac is completely obliterated, and it is impossible for it to reinvert through the femoral ring.

In the cure of inguinal herniæ by this method, only those cases in which the sac is of small size are suitable, that is, the entire sac must necessarily be pulled back into the abdomen and the pillars of the internal ring sutured with mattress sutures of linen or silk, similar to the femoral hernia just described.

In treating umbilical herniæ by this method, it has been our custom, on most occasions, to re-invert the sac of the hernia as described, although, in some instances, we have simply stitched up the ring with mattress sutures of linen, paying no attention to the sac, and have obtained equally good results.

CONGENITAL MALFORMATIONS OF THE URETERS.

BY DANIEL N. EISENDRATH, M.D.,

OF CHICAGO, ILLINOIS.

THE object of the present paper is to add another case of congenital malformation of the ureter to the series of four similar cases reported by the writer in two previous articles, published during the past year.[1]

In order to permit of a survey of the entire five cases, and to bring out the various forms and clinical pictures shown by them, I will give a brief synopsis of the already published first four cases.

CASE I.—*Congenital Hydronephrosis of a Horseshoe Kidney.*

Boy of six, with severe right abdominal pain, septic symptoms, and palpable transverse tumor (Fig. 1) in upper abdomen. Latter at operation seen to be a hydronephrotic horseshoe kidney. Ureter not enlarged. Operation consisted of draining sac. Existence of closure or narrowing of ureter at junction with renal pelvis to be assumed from absence of dilatation of ureters and from similar cases collected by Papin and Christian.[2] They found that the cause of the hydronephrosis in fifteen cases of hydronephrotic horseshoe kidneys seen at autopsy was either congenital stricture or faulty insertion of the ureter. In this case the condition had remained latent until infection occurred.

CASE II.—*Congenital Hydronephrosis Due to Stricture at Ureteropelvic Junction.*

Boy of twelve, with enlargement of left side of abdomen, only noticed after sixth year (Figs. 2 and 3). No symptoms referable to urinary tract. Soft elastic retrocolic tumor to be felt to left of median line, extending from costal arch to Poupart's ligament, and having distinct notch. Urine very turbid and con-

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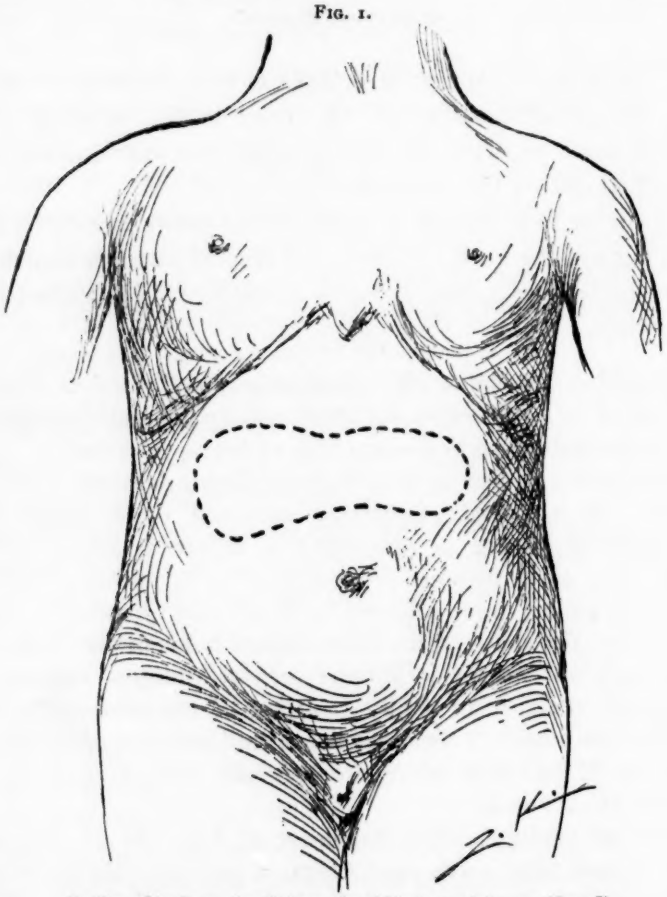
* Read before the Western Surgical Association, December 21, 1911.

[1] Surgery, Gynæcology and Obstetrics, June, 1911, and Jour. A. M. A., July 8, 1911.

[2] Annales des Mal. d. Organes Genito-Urin., vol. xxviii.

tained many pus corpuscles. No fever or other evidence of infection, only marked malnutrition. At operation an immense hydronephrotic kidney was found. The sac contained two quarts of turbid fluid, which showed no growth on the ordinary media. The pelvis and calyces were enormously dilated at the expense

FIG. 1.

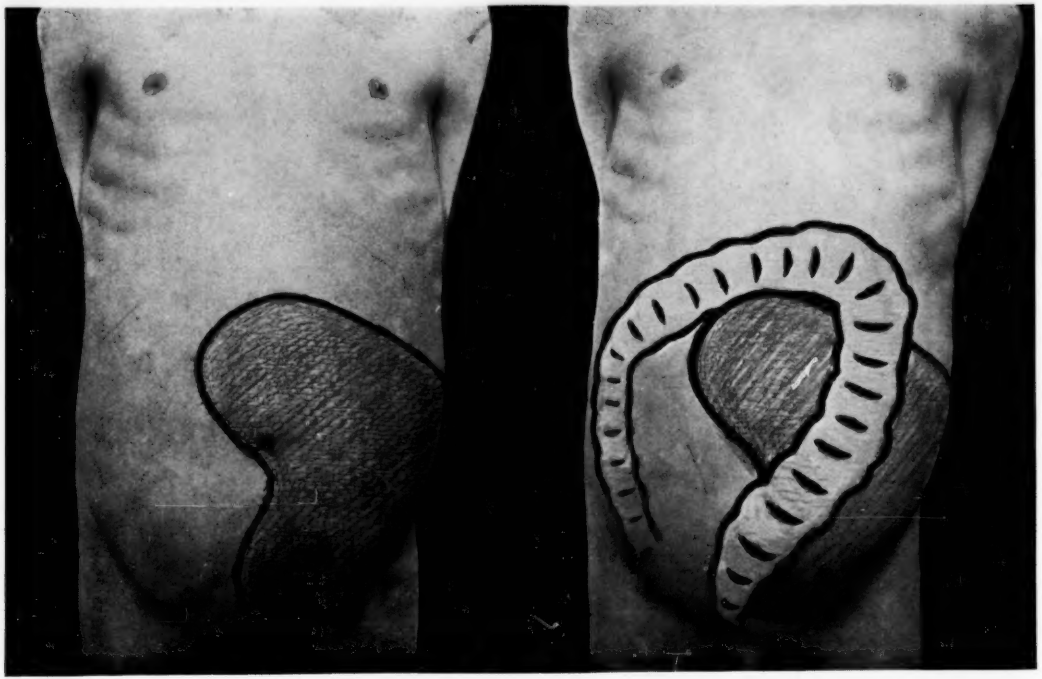


Outline of hydronephrotic horseshoe kidney on abdomen (Case I).

of the parenchyma (Fig. 4.) The cause of the obstruction was found to be a sudden narrowing of the ureter (Fig. 5) at its junction with the renal pelvis. It was impossible even to pass a filiform bougie through the ureteral lumen at the point of obstruction. After removal of the kidney, patient made an uneventful recovery, and has remained well.

FIG. 2.

FIG. 3.



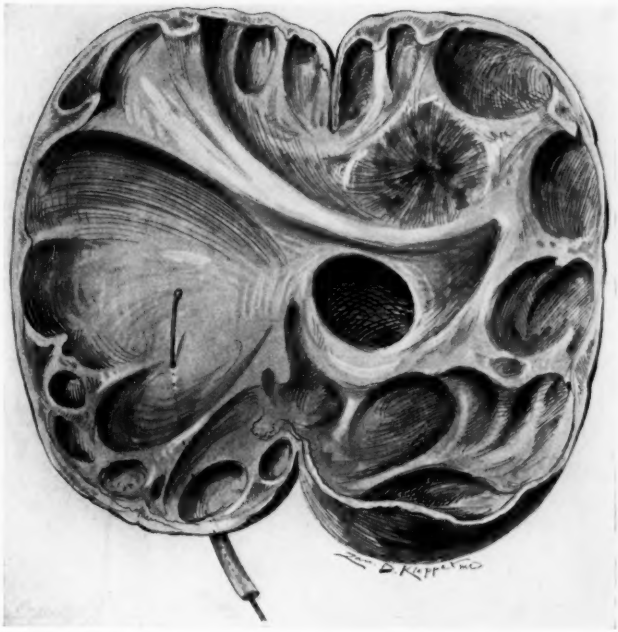
Front view of abdomen in congenital hydronephrosis (Case II).

Result of inflation of colon in Case II.

FIG. 4.

Front view of kidney of Case II. This shows the enormous dilatation of the pelvis and the narrow margin of parenchyma with prominences due to dilated calyces. Note narrowness of ureter at junction with pelvis.

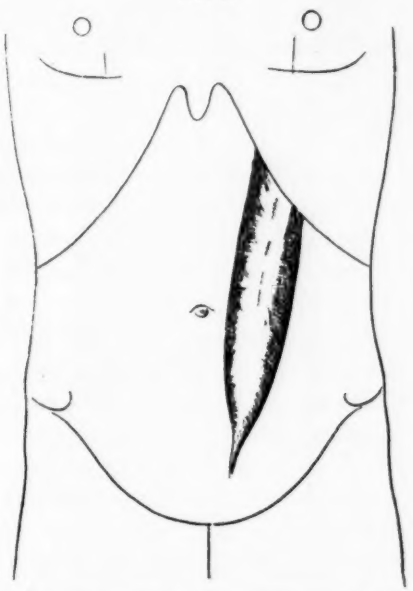
FIG. 5.



Interior view of kidney of Case II. Note narrow rim of kidney tissue, dilated calyces and pelvis, and small orifice of ureter (probe inserted through ureter).

CASE III.—Boy of fourteen, previously well, was suddenly seized with left-sided abdominal pain. Latter was most marked in the left iliocostal space and radiated toward front of abdomen. Temperature 101°. Left side of abdomen rigid. Urine contained a few pus corpuscles. Urinary retention was present, so that it was necessary to catheterize. No cystoscopic examination or collargol injection of the ureter was made. Diagnosis before operation was some left intraperitoneal infection, possibly appendix or diverticulitis of sigmoid. Under anæsthesia spindle-

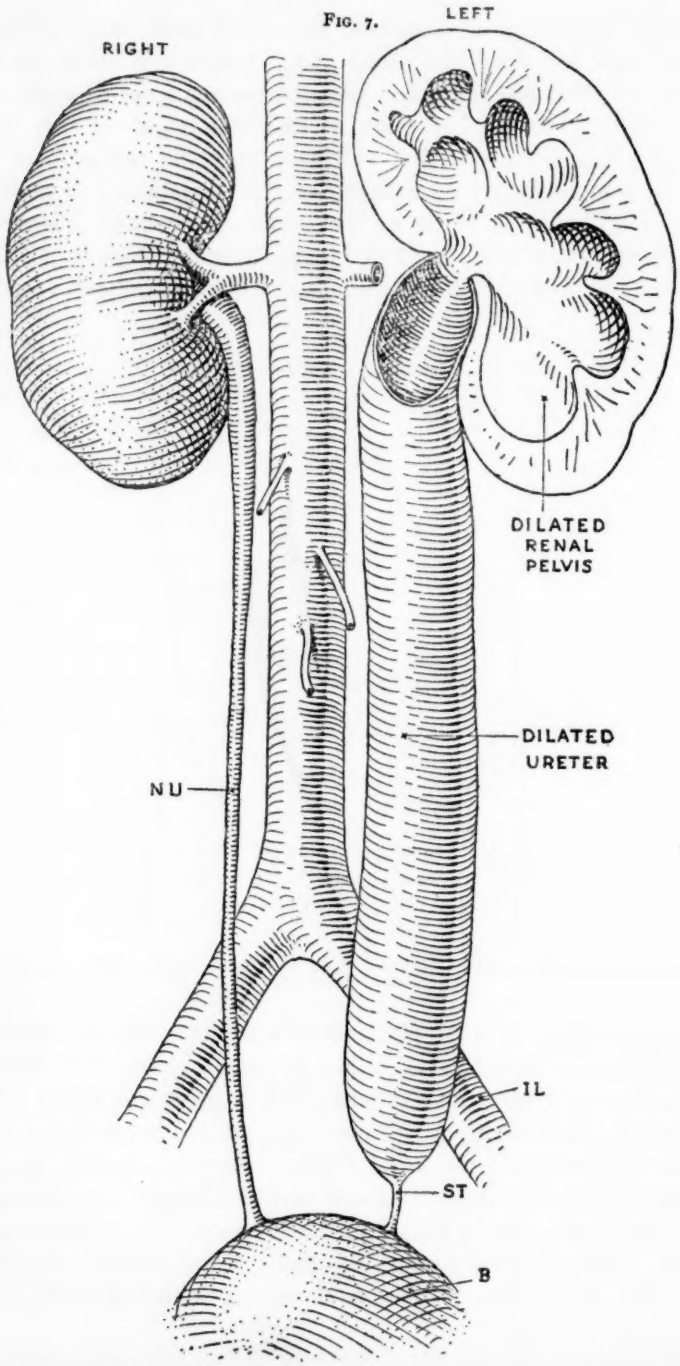
FIG. 6.



Spindle-like tumor felt on outer side of left rectus (under anæsthesia). It tapered toward pelvis. (Case III).

like tumor (Fig. 6) to be felt beneath left rectus muscle, tapering sharply toward true pelvis. When peritoneal cavity was opened, a translucent, elongated, fluctuating enlargement was found lying behind the peritoneum, to the inner side of the descending colon. Ureter exposed through usual oblique incision. Tissues around ureter found œdematous, as if the seat of a recent infection, and upon incision a slightly turbid serum escaped. No cultures were made. Ureter dilated to size of small gut, with walls extremely thin and easily torn. Dilation showed gradual narrowing at

FIG. 7.



Author's case of congenital stenosis of left ureter (see text). *NU*, normal right ureter; *IL*, iliac artery; constriction (*ST*) was just distal to place where ureter passes across vessel. *B*, bladder. (Semidiagrammatic.)

junction with renal pelvis above, and a quite sharp termination at lower end, just below brim of true pelvis (Fig. 7). From this point downward ureter felt hard and fibrous, but allowed an ordinary ureteral catheter to pass through into bladder. The ureter above this narrower pelvic portion was found to be of tissue-paper thinness, with markedly œdematous and reddened mucous membrane. At about the middle of the enlargement two distinct mucous valves were seen, which did not cause any obstruction. Ureter at first drained, but recurrence of fever, which became quite high, necessitated removal of dilated ureter and kidney. The ureter was distinctly narrowed at its junction with the renal pelvis (Fig. 7). There were marked evidences of a recent pyelonephritis, many groups of small abscesses being scattered over the renal cortex. Patient made an uneventful recovery, and has remained well up to present time (eighteen months after operation).

Case IV.—Specimen of kidney, loaned by Dr. I. A. Abt.

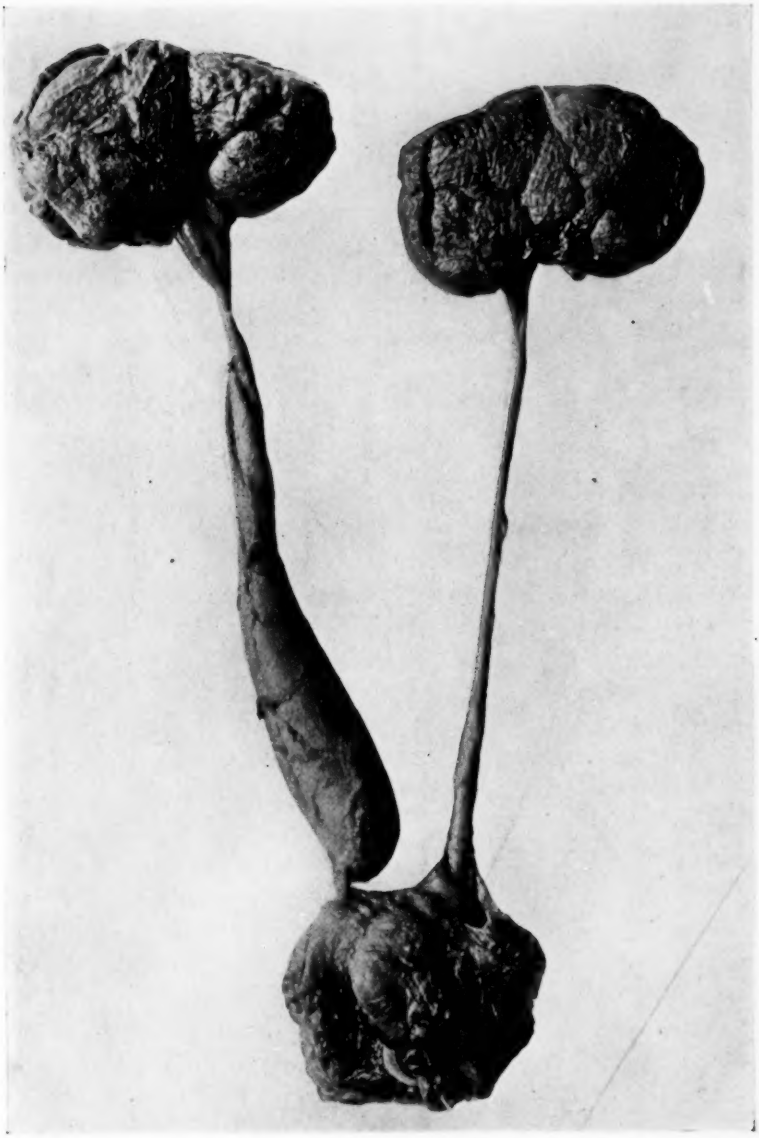
Kidney, ureter, and bladder from a child, ten days old, who had died of icterus neonatorum. The left ureter (Fig. 8) showed two distinct points at which its lumen was impermeable, even to the very smallest bougie. The proximal of these two strictures of the left ureter is one-half inch below the renal pelvis. The distal stricture of the left ureter is one-eighth of an inch above the bladder. A similar proximal stricture was found in the right ureter, five-eighths of an inch below the ureteropelvic junction. There is no distal stricture of this left ureter. There is a marked spindle-like dilation of the ureter, and there is also marked dilation of the ureter and renal pelvis (moderate hydronephrosis) on both left and right sides above the proximal strictures.

The following case was observed since the publication of the preceding four:

Case V.—Girl of sixteen, but with physical and mental development of child of six, was admitted to the service of Dr. I. A. Abt, in the Michael Reese Hospital. She had always been backward in intelligence and size, and showed all of the stigmata of cretinism. Her history was that of the sudden onset of severe pains in the abdomen, accompanied by frequent vomiting. This condition had lasted for about two weeks prior to her admission.

The abdomen was enlarged and soft. There was tenderness and a feeling of resistance, or of a mass over the right kidney, but nothing definite. No evidence of free fluid to be found. She was transferred to the surgical service of the writer, with the diagnosis of a probable right kidney tumor. My examination, in addition to confirming the presence of marked retardation of mental and physical development, showed the presence of a suprapubic soft enlargement, which entirely obscured the possibility of palpating the tumor previously thought as present by Dr. Abt. Owing to her irritability and the inability to reason with her, it was impossible to obtain any urine or to make a satisfactory abdominal examination until she was anæsthetized. Upon inserting a catheter, a very large amount of turbid urine was evacuated and the greater part of the suprapubic enlargement disappeared. Our suspicion entertained before anæsthesia, that the suprapubic enlargement was due to a greatly distended bladder, seemed at first to be confirmed. But in spite of suprapubic pressure, the catheter being left in the bladder, some enlargement remained, and I decided to open the abdomen in the median line and explore the peritoneal cavity. This was done and showed that both ureters were dilated, the left one far more so than the right. The left ureter could be seen to be about the dimension of the adult thumb. The enlargement seemed to be uniform, *i.e.,* it extended without any narrowing to the kidney above and bladder below. The corresponding (left) kidney was the size of the adult fist and markedly hydronephrotic, showing a number of translucent prominences corresponding to dilated calyces. The right ureter was about the size of a lead pencil, and much less translucent than the left one. The right kidney was only slightly hydronephrotic. No cause for the obstruction in the left ureter was found *proximal* to the bladder. The latter could still be felt to be considerably enlarged, so the first incision was closed and a second lower extraperitoneal opening made, just above the pubes, the bladder brought into wound, and opened. A very large quantity of turbid urine escaped. The walls of the bladder were greatly hypertrophied and a projection into the lumen was to be distinctly seen on the left side (Fig. 9). It looked like an elevation of the bladder wall covered by smooth mucosa, which seemed to fill up almost the entire bladder, projecting beyond the median line and

FIG. 8.



Specimen obtained at autopsy from Dr. Abt's case of infant, 10 days old, who had died of icterus neonatorum. Note narrowing of ureter just above bladder and again just below renal pelvis. Proximal to each one of these narrowings or stenoses is a marked discoloration. (Case IV.)

FIG. 9.

Appearance of bladder at operation. Cystiform protrusion seen on left side (retracted so as to show relation to right ureteral orifice and to internal meatus). (Case V.)

anteriorly, so that it was necessary to hold it back with a retractor to expose to view the right ureteral orifice and the internal meatus, both of which this prominence covered.

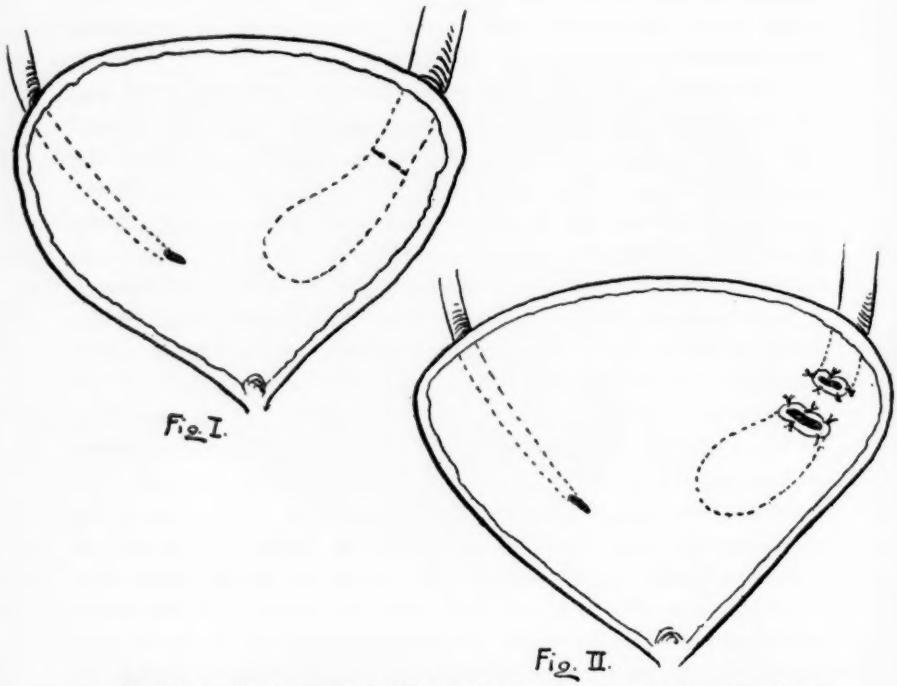
It looked not unlike the bulging of a rectocele, seen in a case of marked perineal tear. Examination of the right ureteral orifice and internal meatus showed that both were permeable in a normal manner. Most careful search was made for a left ureteral orifice, but none found. A diagnosis of cystiform protrusion of the lower end of a congenitally closed ureter was made, and a plastic operation begun, so as to create a permanent left ureteral opening into the bladder.

The mucous membrane covering the cystiform protrusion was incised and the greatly dilated ureter exposed. This was opened and divided transversely into a proximal and distal portion, the point of division being about one and a half inches above the lower end of the dilatation. The new ureteral openings were formed by uniting the mucous membrane of the bladder, as shown in Fig. 10, with the wall of the divided ureter. Although a probe was shown to have a wide range of movement in the distal portion of the cystiform protrusion of the ureter, no communication with the bladder lumen was found. A case of Bostrom's, reproduced in Fig. 16, will give one the best idea of the condition, as found by us at operation. The ureter opened widely into the protrusion, and I thought it advisable to establish a permanent means of communication (Fig. 10) between the distal portion and the bladder lumen, in order to permit of drainage of this distal pocket. It would, of course, have been ideal to make the new and only ureteral opening at the distal end of the dilatation, but it was impossible to find this end until we had made our incision through the posterior bladder wall and opened the ureter at a point a little higher up. This case, so far as I can learn, is the first one in which an intravesical ureterostomy for a congenital cystiform protrusion was performed. That the opening remained perfectly patent was shown by the fact that it was found to admit a No. 5 English soft rubber catheter at the autopsy, held nearly four months after this ureterostomy operation.

The only manner in which I can explain the retention of urine, resulting in the suprapubic tumor felt before this first operation, is that the cystiform protrusion, filled with urine, so filled up the

bladder lumen as to obstruct, not only the internal meatus, but also the right ureteral orifice. Before we could expose the right ureteral orifice, in order to determine its permeability to a catheter after opening the bladder, we were obliged to strongly retract the cystiform protrusion to the left. It is my opinion that the urine from this left kidney probably passed by filtration into the bladder lumen or through some minute opening which

FIG. 10.



Plastic operation to correct cystiform protrusion. I, course of both ureters before ureterostomy (note dilated lower end of left ureter). II, method of suturing proximal and distal portions of ureter into bladder.

we did not find. It would seem reasonable to expect a very much more marked hydronephrosis on the left side, if none of the urine had escaped during the sixteen years of her life.

After this ureterostomy, on May 20, 1911, both laparotomy and suprapubic wounds healed very slowly. From May 20 until June 20, the temperature was practically normal, seldom rising as high as 100° F. Beginning June 20, the temperature began to rise, reaching its first high point on June 26 (102.5° F.).

From this date to July 20, there were four febrile periods, lasting on an average from two to four days, with intervals of two to three days. The diagnosis of ascending infection, from the bladder, of the left kidney was made. An exploratory operation to determine the condition of this kidney was decided upon. This was performed on July 25, 1911.

The kidney was brought into the abdominal wound. Its cortex showed a very large number of deep hemorrhagic spots, and at the upper pole there were a number of pin-point yellowish pus foci. Both of these findings confirmed the diagnosis of a pyelonephritis. It was at first thought possible to save the kidney by simply incising these pus foci, but owing to the spiral twist of the ureter described below, this was deemed inadvisable. It was found that the pelvis of the kidney was quite large compared to the size of the kidney itself. This enlargement extended down into the upper portion of the ureter, which was also greatly dilated down to a point about 4 cm. below the kidney. The form of the enlargement was like that of the bowl of a pipe. The enlargement stopped suddenly at a point where the ureter seemed obstructed by a *complete spiral twist of over 180 degrees*[1] (Fig. 11). There was a second spiral twist about 2 cm. below this one. On account of the infected condition of the kidney and the difficulty of performing a plastic operation to join the ureter at a point below its second spiral twist with the pelvis of the kidney, it was deemed best to perform a nephrectomy. Before performing this, search was made for the possibility of an accessory vessel which could cause an obstruction of the renal pelvis, but none was found. The description of the removed kidney and removed ureter is as follows:

Left kidney and ureter removed July 25, 1911.

Ten cm. long by 4.5 wide by 2 cm. thick. Fetal lobulations were well marked. The cortex showed innumerable petechiæ at the upper pole and there were a number of pin-point areas which, on section, were seen to be small pus foci in the cortex. Surface of cortex rough and somewhat nodulated. Section showed renal pelvis greatly dilated and a moderate degree of hydronephrosis.

[1] Both the upper or major and the lower or minor twists were not the result of traction. They were demonstrated to a number of visitors, with the kidney in its normal position, without the least degree of torsion of the same (Fig. 11).

Pelvic mucous membrane smooth and shiny, except for a few punctate hemorrhages. Dilatation of pelvis extended into upper portion of ureter for a distance of nearly 4 cm.

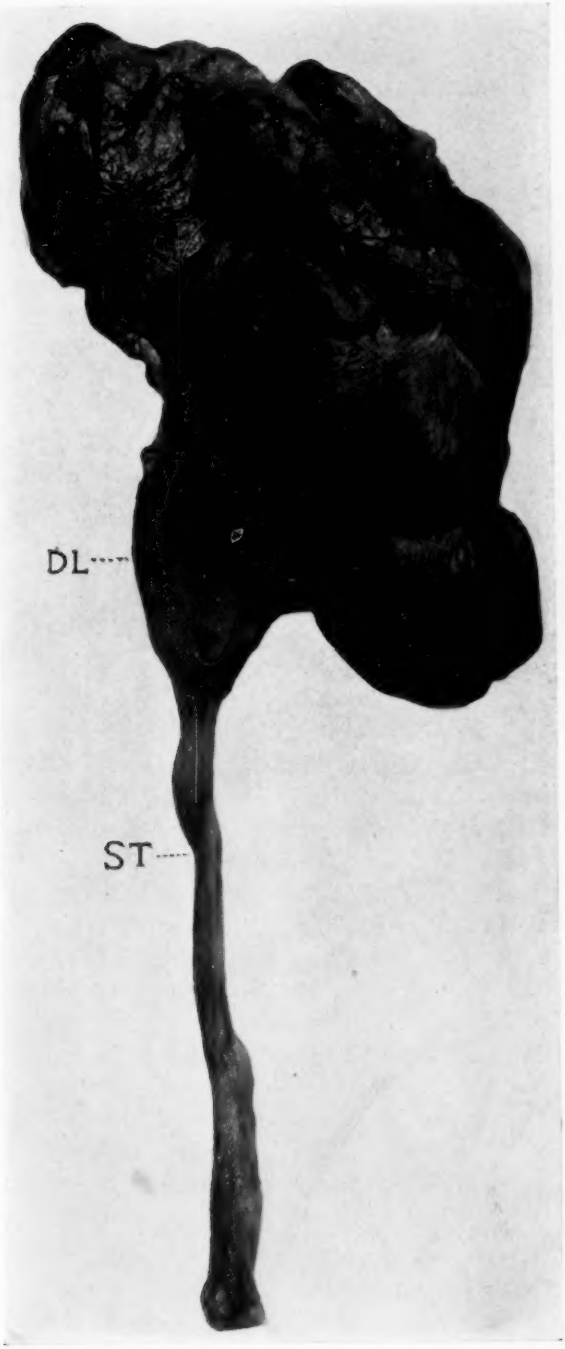
The ureter showed an enlargement extending to about 4 cm. below kidney, resembling the bowl of a pipe, just distal to which was a peculiar twist in the ureter spiral, to the long axis of the ureter, so that when ureter was placed in the position occupied in the body there was an almost complete closure of ureter at this point, due to the spiral twist of nearly 180° and enlargement above it. There was a second spiral twist in the ureter, about 3 cm. below the one described above, and a tendency to a third a similar distance lower down. From this point toward the bladder, the ureter was quite large and showed no twists. The walls were thickened. Upon inserting a probe from the lower end of the ureter upward, one met with obstruction at the above-described twists, especially the one nearest to the renal pelvis.

Post-operative Notes.—The kidney wound healed without complications. The patient, however, continued to look very pale, although passing a large quantity of urine, which, microscopically, showed a considerable number of pus corpuscles and traces of albumin. The microscopic examination of the tissue of the left kidney showed a high grade of chronic diffuse nephritis, with small focal areas of polymorphonuclear leucocytes. Patient continued to feel well, being up and about, and shown in clinic a number of times. She was discharged from the hospital on October 15, apparently greatly improved, but returned on October 21, with symptoms of laryngeal stenosis and pulmonary œdema, due to uræmia, with resultant general anasarca, and died on October 25, 1911.

The autopsy showed an absence of the thyroid, thus confirming our clinical diagnosis of cretinism. I shall only add the report on the autopsy specimen of the right kidney, right ureter, and stump of the left ureter (Figs. 12 and 13).

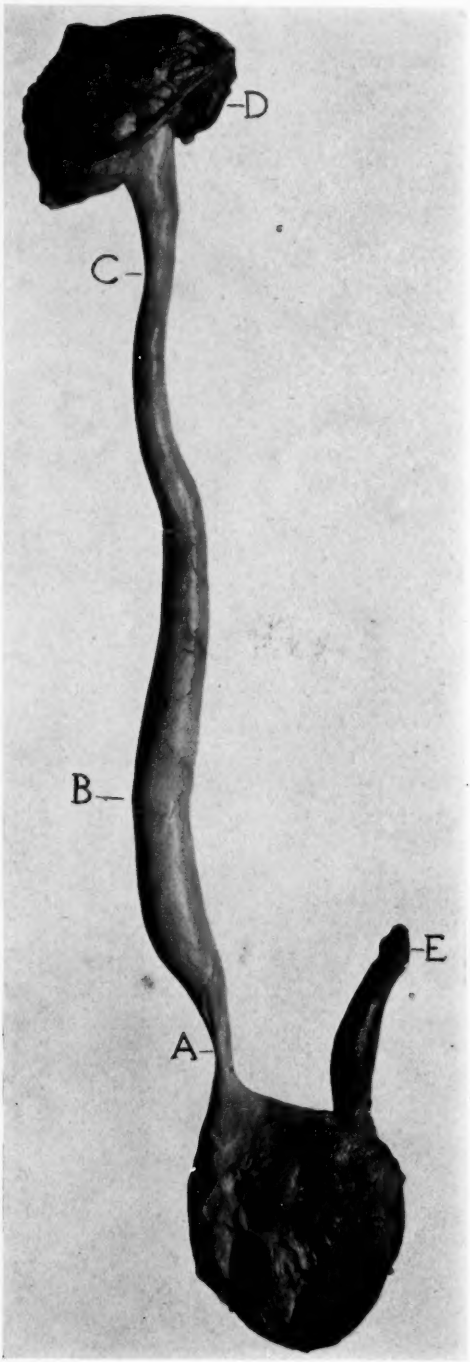
The stump of the right ureter was two and a half inches long. From a point about one-quarter of an inch above its entrance into the bladder wall it became dilated. The convexity of the dilatation was toward the left; in other words, not symmetrical. The concave surface of the dilatation in this ureter faced the concave surface of the dilatation in the right ureter. The diameter of the dilated portion of this ureter at its widest point when filled with paraffin was almost one-half inch. Where it nar-

FIG. 11.



Kidney from Case V showing spiral twist of ureter. *DL*, dilated ureter above point of stenosis; *ST*, spiral twist in ureter, causing stenosis.

FIG. 12.



Congenital stenosis of the ureter (Case V). Note constrictions at *A* and *C*, and dilatation at *B*. *E* is stump of left ureter; *D*, right kidney.

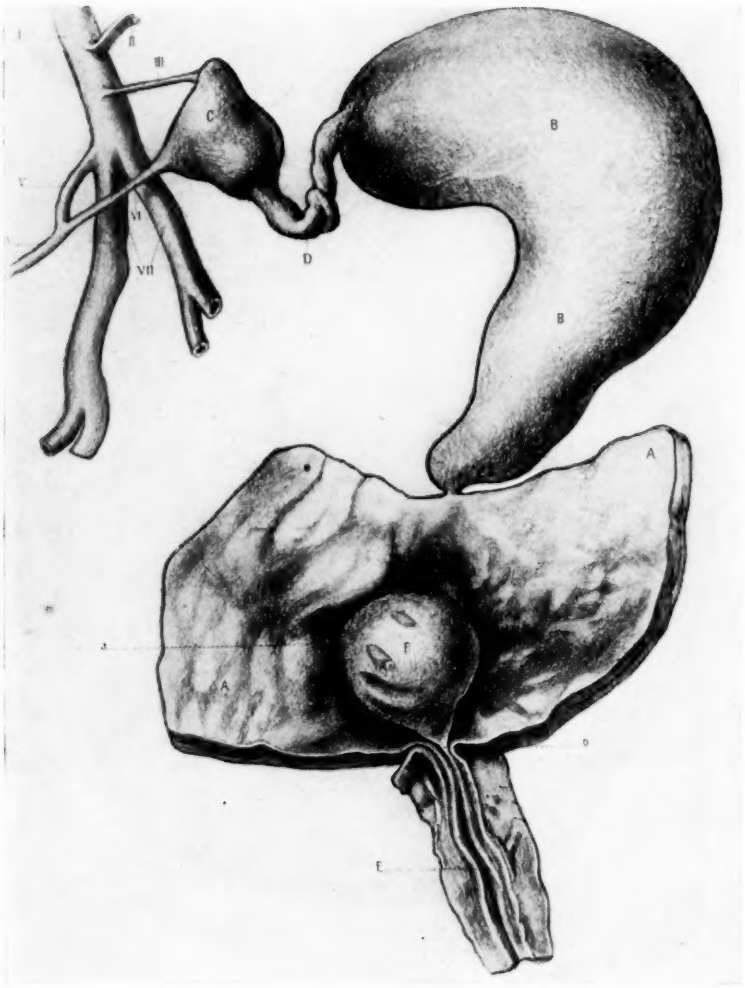
FIG. 13.

Right kidney, ureter and bladder (removed at autopsy of Case V). Bladder opened to show patent ureterostomy (left) and dilated right ureter and kidney.

FIG. 14.

Case showing protrusion into bladder (Johnson's case). Right kidney enlarged and its pelvis distended. Right ureter dilated and curving. Double ureters on left side, both dilated and tortuous. Protrusion extends from left ureter into urethral canal (see text).

FIG. 15.



Congenital closure of left ureter, with protrusion of closed vesical end into bladder. Enormous dilatation of left ureter. Marked atrophy of left kidney. (Bostrom's case.)

FIG. 16.

Cysiform projection of right ureter into bladder. Ureter opens widely into protrusion. (Bostrom's case.) (Type of Case V.)

rowed just before entrance into the bladder wall, it was one inch in diameter. The description of the vesical orifice of this ureter will be found under the description of the bladder. The right kidney was two and three-quarter inches long, one and one-half inches in width, and three-fourths inch in thickness.

The kidney showed no abnormalities in shape; the fetal lobulations were still quite marked. The true capsule was quite adherent, being almost impossible to strip. Distributed over the cortex of the kidney were a number of pin-point, yellowish areas, which upon section were seen to be small collections of pus. A similar condition was found at the operation of July 25, 1911, in the left kidney which had been removed. In addition to these yellowish areas, the surface of the kidney showed a number of pale yellowish elevations. The surface resembled that of a chronic interstitial nephritis. On section of the parenchyma, considerable purulent fluid escaped from the pelvis and dilated ureter. The cut surface of the kidney showed that the pelvis of the kidney was greatly dilated at the expense of the parenchyma. The calyces were markedly dilated and contained a turbid yellowish fluid. The pelvic mucous membrane lining these dilated calyces showed intense injection of the blood-vessels, and in places there was a considerable velvety appearance of the mucosa, *i.e.*, the typical picture of a chronic pyelitis. The parenchyma on section seemed to be present only to a small degree, maximum width being one-quarter inch. The parenchyma, wherever present, showed marked glomerular injection. The right ureter showed a marked constriction close to the point of entrance to the bladder. This narrow point corresponded to that on the left side, about one-quarter inch in diameter, and extended about one-half inch in a vertical direction.

From this point upward, for a distance of nearly four inches, occurred the first spindle-like dilatation of the ureter. The concavity of the spindle was toward the median line. Just above this point the ureter again narrowed and there was an incomplete spiral twist at this point. This was followed by a second spindle-like dilatation, which was shorter and ended about one and a half inches below the ureteropelvic junction. At this point there was a second less complete spiral twist.

Bladder specimen: Internal meatus readily admitted a No. 5 soft rubber catheter. The right ureteral orifice was distinctly visible, and showed no abnormalities and easily admitted ordinary probe. The left ureteral orifice corresponded to the point where the previous plastic operation had been performed. This readily admitted a No. 5 soft rubber catheter. Dissection of the bladder wall for traces of a previous distal pouch corresponding to the lower end of the cystiform protrusion of the ureter was negative. This was, in all probability, due to the fact that between the date of operation of the ureter and the date of dissection of the specimen (six months), cicatricial contraction of this segment had caused complete obliteration of its lumen. There were absolutely no traces of any other ureteral orifice, which confirmed the observation made at the first operation, that no left ureteral orifice could be found, the orifice being simply represented by a little dimple covered with mucous membrane. The bladder walls showed marked hypertrophy, as

though great difficulty had been encountered in evacuating the urine, due no doubt to obstruction of the internal meatus by the cystiform protrusion.

REVIEW OF LITERATURE.

In my previous article I expressed my indebtedness to Dr. John T. Bottomley for the painstaking manner in which he collected all of the cases published up to the date of appearance of his article upon "Congenital Strictures of the Ureter," published in the ANNALS OF SURGERY, November, 1910. In order to better understand the nature of these congenital lesions of the ureter, I shall briefly review some of the chief points of my first paper.

ETIOLOGY.—This is not quite clear, but is best explained as either the result of the persistence of fetal conditions or a retardation of development of structures destined to perform important functions.

Persistence of fetal conditions:

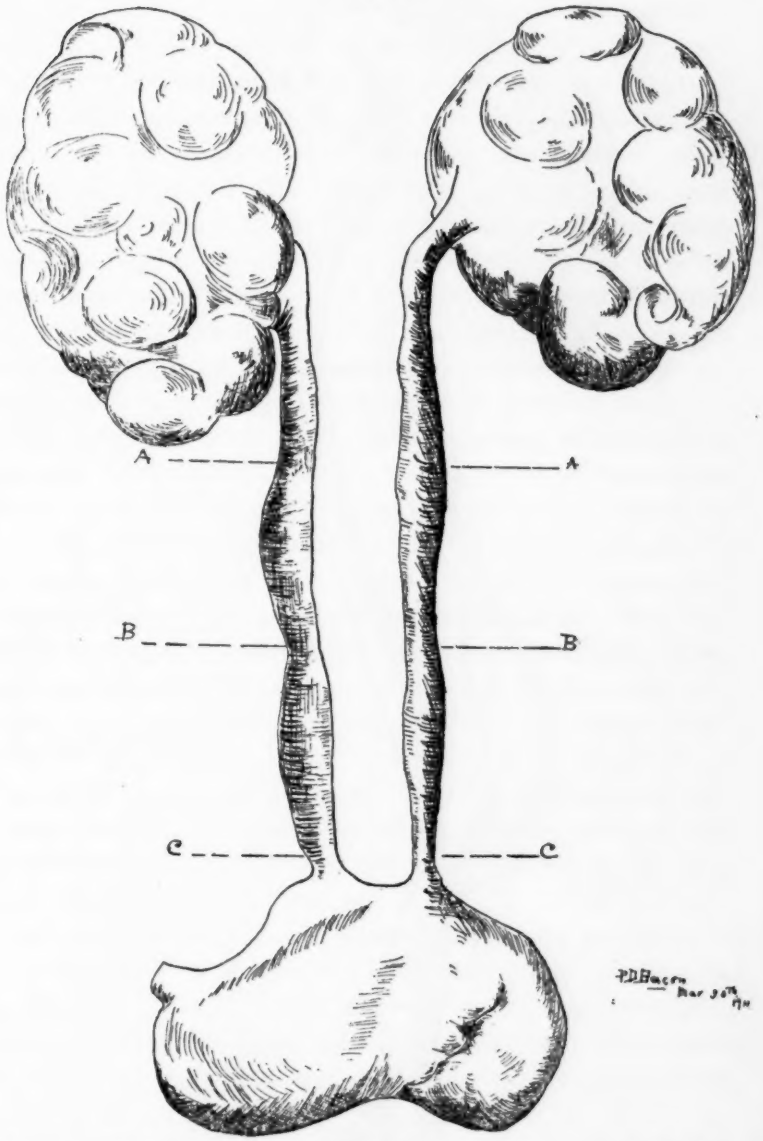
Seitz, Byron Robinson, Hamann, and others have shown by their studies of the normal ureter, in the fœtus and at different periods of post-uterine life, that the ureter in all mammals possesses certain more or less constant points of narrowing and of dilatation. In addition, the occurrence of valves and of twists or tortuosities is not at all uncommon, especially in the fetal ureter. Figs. 17, 18, and 19 show where these various conditions most frequently occur. The points of narrowing are as follows:

1. Just before the ureter enters the bladder wall (*C* in Fig. 17).
2. Where the ureter crosses the pelvic brim (*B* in Fig. 17).
3. Close to the pelvis of the kidney (*A* in Fig. 17).

These three points of narrowing become more marked toward the end of fetal life, as Seitz has shown, and were constantly found in the normal adult ureter by Robinson.

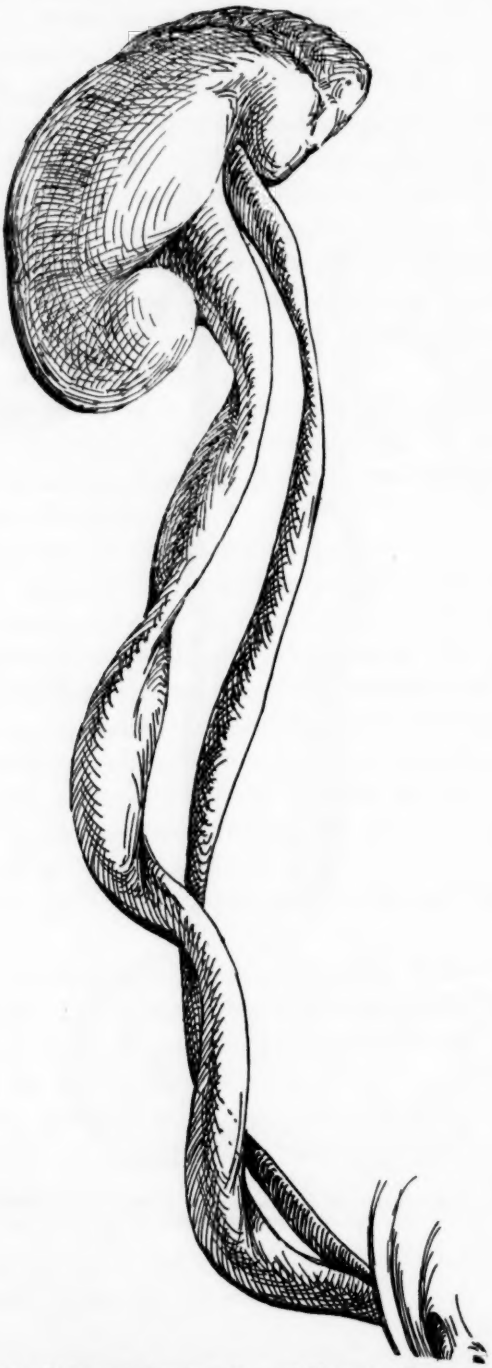
The dilatations are always found on the proximal side of these narrowings in the normal human fœtus. The most marked widening is situated in the middle third of the ureter, *i.e.*, proximal to the narrowing which occurs at the pelvic brim or between it and the bladder wall.

FIG. 17.



Fetal ureters (Seitz) showing normal constrictions (*A*, *B*, and *C*) and normal dilatations on their proximal side.

FIG. 18.



Case of double ureters showing twists and dilatations (Byron Robinson).

The spiral twists occur at any point, but are most marked at the junction of the upper and middle thirds of the ureter, as in the writer's case (Case V). The rôle which valves play in the production of stenoses is not quite clear. They are found in about 20 per cent. of cadavers of normal children, and contain mucous membrane, submucous and muscular tissue. In some cases the ureter is stenosed at the point where valves are found, and in all probability the valves play a rôle here.

CLINICAL IMPORTANCE.—The presence of the narrowings, twists, and valves, as found in the normal fetal and adult ureter, was formerly thought to be of interest to the anatomist and pathologist alone. Although a number of the cases collected by Bottomley were reports of specimens found at autopsy, yet in quite a large number the persistence of these congenital conditions gave rise to symptoms requiring operative measures. We shall see later that there are many cases which remain latent throughout life, and, on the other hand, quite a number in which infection or the presence of a tumor cause symptoms which draw the clinician's attention to the case.

In several of the cases collected by Bottomley, a portion of the ureter was wholly fibrous, while in others the ureter was impermeable throughout and was represented only by a fibrous cord, a functionless ureter. Teyssèdre[4] collected reports of eleven cases. Such a fibrous ureter may lead to absence of the kidney or of the whole or a portion of the ureter. In eight cases of Bottomley's series the stricture was located in the upper third of the ureter, usually at or close to the opening into the renal pelvis.

In 36 of 56 cases the obstruction was in or very close to the bladder; 17 of Bottomley's cases had vesical protrusions, 39 did not. Nichols's and Abt's (Fig. 8) cases showed a stricture both at the upper and at the lower end of the same ureter. The same ureter may present alternating portions with and without a lumen.

The most important, and, in their effects, the most far-

[4] Thèse de Paris, 1892.

FIG. 19.

Sagittal section of adult human ureter, showing spiral twists, constrictions, and valve formation (Byron Robinson).

reaching modifications of form are seen in the obstructions at the lower end of the ureter. In these the ureter usually reaches the bladder, but in most instances ends there in a blind sac. This blind end may be (*a*) just beneath the mucous lining of the bladder, (*b*) it may lie in the muscular layer of the bladder wall, or (*c*) may just reach the outer wall. If the blind end is in the muscular layer and one examines the bladder from within, there will either be no trace whatever of a ureteral opening, or in its place will be seen a dimple, a shallow invagination of the mucous membrane.

The most interesting forms, however, have to do with the ureters ending just beneath the vesical mucous membrane, as in my Case V. These produce a cyst-like protrusion of the mucous membrane into the vesical cavity. The protrusions range in size from that of a small pea to one completely filling the bladder lumen; the smaller are usually hemispherical in shape; the larger are either triangular or finger-shaped, sometimes reach the vesical opening of the urethra, may pass varying distances along the course of the latter, and in women may even appear at the external meatus. When empty, they are flat and flaccid; when full, they are finger-like, pear-shaped, and tense, broader and thicker at the base, gradually tapering and thinning in the direction of the tip. They vary in length from 0.5 cm. to 6.5 cm. The ureteral opening into these pouches may be bristle-like or may be an aperture 2 cm. in diameter. Usually (in 12 out of 17 cases) the protrusions are blind cul-de-sacs without an opening into the vesical cavity. In five cases there was a communication between the protrusion and the vesical cavity, almost invariably by minute openings at the tip or on the side of the former. The contents of the protrusions is usually a clear fluid. It may vary considerably in color. Sometimes it is muddy or cloudy.

Effect on Ureter.—When the obstruction is at the lower end, the ureter is almost invariably dilated, thin-walled, and tortuous. It varies in size from that of a pencil to that of the

small intestine (Fig. 7). It becomes widened and lengthened. Occasionally it is lobulated, shows windings and twistings (Figs. 11, 12, and 13), the latter also causing obstruction as in my fifth case.

Effects on the Renal Pelvis and Kidney.—Either an enormous hydronephrosis or a most marked primary atrophy may result from ureteral obstructions of the same location and character. Hydronephrosis of varying degree is the rule. It may show itself simply as a slight or a moderate distention of the pelvis, as in Case III, or it may present as an enormous cyst filling the whole abdominal cavity, with only remnants of the true kidney tissue in the cyst wall, as in Case II. Infection produces its usual disastrous effects, and in some cases completely disorganized kidneys are found.

Effects on the Bladder.—The cystiform protrusions of the blind ending ureter into the bladder may cause marked secondary pathologic changes in the bladder, as well as in the other ureter, or in the other kidney, as in Case V. The protrusion may block the opening of the opposite ureter. In other cases it may wholly obstruct the vesical opening of the urethra, give rise to a distended hypertrophied bladder, and then the usual sequelæ of retention of urine result. Both the right ureteral orifice and the internal meatus urethræ were blocked by the cystiform protrusion in Case V and the bladder walls greatly hypertrophied.

Symptoms and Diagnosis.—In Bottomley's series, 19 cases gave either subjective or objective symptoms. Many cases occurred in subjects too young to make complaints. Hydronephrosis of great size and protrusions filling the bladder may exist for years without symptoms, unless infection occurs.

A survey of all the published cases of congenital anomalies of the ureter shows that clinically they belong to one of four classes: (1) Those in which the condition remains latent throughout life and is an accidental finding at autopsy. The majority of the published cases belong to this class. (2)

Those in which the presence of an abdominal tumor, which may or may not be diagnosed before operation as being of renal origin, is found when the abdomen is opened. My first and second cases belong to this class. In the first case the boy was thought to have an appendiceal abscess, on account of the persistence of the septic symptoms and the prominence of a tumor in the right hypochondrium, which was found at operation to be a hydronephrosis of the right half of a horse-shoe kidney. My second case was diagnosed before operation as being a renal tumor, and in all probability a hydronephrosis. The probable congenital origin of the hydronephrosis was also diagnosed before operation, on account of the age of the patient—twelve years. The operation verified this diagnosis. (3) Cases in which the predominant symptoms are those of an abdominal infection. The clinical picture may resemble that of an acute infection of one of the intraperitoneal viscera, or it may point more directly to the kidney and ureter as the source of the symptoms of infection. My third case resembled a case of Bottomley's in presenting the picture of an intra-abdominal infection whose nature could not be accurately determined until operation. In my own case (Case III) the symptoms had begun very acutely, with pain and rigidity in the left half of the abdomen, and only under anæsthesia was it possible to palpate what would seem to be rather a characteristic finding in these cases when it is present. This was also present in Bottomley's case. This is the palpation of a sausage-shaped tumor extending from the costal arch toward the pelvis and tapering somewhat from above downward. In cases where one suspects a dilated ureter and such a finding is present, one could easily confirm the diagnosis, if operative interference were not urgent, by filling the ureter with collargol solution and then taking an X-ray. (4) Those cases in which disturbances of micturition are the principal symptom. This consists either of increased frequency or retention. My fifth case belongs to this class. The principal symptom was a suprapubic enlargement, which was deter-

mined to be only in part due to a distended bladder. The catheterization in this case showed that there was still a tumor present, in spite of the evacuation of a considerable quantity of urine. In such a case or wherever there is a history of increased frequency of micturition in children, not due in all probability to any other cause, one should always bear in mind the possibility of a protrusion of the closed or almost closed lower end of the ureter into the bladder—what has been spoken of frequently in this article as a cystiform protrusion.

The examination of the urine is of little value, unless infection has supervened, and even then there is nothing specific to be found. In the second and fifth cases the urine contained a considerable number of pus corpuscles, without any active evidences of infection.

I have noticed one striking feature, and that is that these children who have congenital lesions of the ureter and kidney seem not to be as well developed as other children of the same age.

In no case thus far published, with the exception of my second case, was a diagnosis of congenital lesion of the ureter made before operation. I do not doubt, however, that since the attention of surgeons has been directed to these malformations of the ureters by the articles of Bottomley and the writer, that the condition will be more frequently recognized in the future. No doubt many cases will be recognized before operation, and at least the possibility of the presence of a congenital malformation be suspected, when a hydronephrosis is found in children. Cystoscopic examination will, of course, show the presence of cystiform protrusion, and it will be impossible in such cases to enter the ureter on the side of this protrusion, in many cases. When there is a ureteral opening present and the stenosis is higher up than the bladder, it may be possible in the future to distend the ureter with collargol and thus make a diagnosis from the radiographic examination.

TREATMENT.—The treatment depends, first, upon the degree of stenosis; second, upon the damage to the kidneys due

to the ureteral obstruction; and, third, upon whether infection is present or not. In the latter class of cases nephrectomy is, as a rule, the only method of treatment. If the kidney has not been too greatly damaged, it may be possible to perform a pyelo-ureteroplasty or implant the ureter into the bladder from a point above the stenosis. Some work has been recently done toward making artificial ureters, and I had intended in my second case to attempt the implantation of the Fallopian tube from a dog, in order to make an artificial ureter, but this was impossible, on account of the presence of pyelonephritis on the side of the stenosis. Cases have been operated on by Drew, Dudley Allen, Whipple, Mayo, Nichols, Bottomley, and myself. Of Drew's cases, one was cured and the other relieved by pyelo-ureteroplasty, the congenital stricture being near the pelvis in both cases. It was my intention to perform an operation of this kind in my fifth case, but the infected condition of the kidney and the complete twist in the ureter seemed insurmountable obstacles. In cases operated on by Dudley Allen and Whipple, nephrectomy was performed in both cases, successfully in Whipple's case, but in Allen's case a pyelonephritis developed and the patient succumbed. Mayo's, Nichols's, Bottomley's, and my first three cases are the only ones in which successful removal of both cause and effect by nephrectomy was accomplished. In my fifth case the patient seemed to recover from the ureterostomy, but nephrectomy was later necessary, on account of the infected condition of the kidney of the same side and the coincident twist of the ureter, shown in Fig. 11.

There are no records of any cases of operation in cystiform protrusion of the lower end of the ureter, and the ureterostomy performed in my fifth case is, so far as I can learn, the first report of an attempt to correct the protrusion of the lower end of the ureter in a congenital case. The autopsy in this case showed that the ureterostomy opening had remained patent and had it not been that the ureter was again obstructed by the twist close to the renal pelvis I have no doubt but that recovery would have been a permanent one. For the first

four weeks after operation the patient seemed to be in excellent condition. During the second four weeks the symptoms of infection due to pyelonephritis of the kidney of this side presented. Following her nephrectomy, two months after the ureterostomy, she had apparently made an excellent recovery until the uræmic symptoms suddenly appeared three months later.

CONCLUSIONS.

1. Congenital malformations of the ureters were formerly thought to be only of interest to the pathologist.

2. The surgical importance of these malformations is just beginning to be appreciated.

3. Four of my cases were found to give rise to clinical symptoms sufficient to require operation. The fifth case was a specimen obtained at autopsy.

4. The clinical picture in these cases varies. In some the abdominal tumor is the most prominent symptom. These are the cases which are generally spoken of as congenital hydronephrosis, where the obstruction is close to the renal pelvis. A second clinical variety is that in which the sausage-shaped tumor extends from the costal arch downward. A third variety is where a protrusion of the lower end of the ureter into the bladder exists. A fourth variety is where the clinical picture is that of a renal infection. Some of these cases may be very difficult to diagnose on account of their resemblance to other varieties of intra-abdominal infection.

5. The origin of all congenital malformations of the ureter is undoubtedly a persistence of fetal conditions. The principal varieties found at operation and autopsy are these: (1) no lumen for the entire length; (2) narrowing or localized absence of lumen at (*a*) ureteropelvic junction, (*b*) upper third alone, (*c*) both upper and lower thirds, (*d*) vesical end (cystiform protrusion); (3) spiral twists, usually one or more; (4) in none of the cases was the lesion due to any accessory renal vessels or any extra-ureteral inflammatory process.

OPERATION FOR ANEURISMAL VARIX OF THE POPLITEAL VESSELS.

BY JOHN CHALMERS DA COSTA, M.D.,

OF PHILADELPHIA,

Gross Professor of Surgery in Jefferson Medical College of Philadelphia.

Longitudinal incision of the popliteal vein. Suture of the opening into the artery from within the vein. Transverse division of the vein on each side of the opening with utilization of the isolated portion of the vein wall for a superimposed flap which was laid over the line of sutures in the artery. End-to-end union of the divided vein.

History.—Miss J., aged twenty-nine, white, native of New Jersey, was admitted to the Jefferson Hospital October 17, 1910. The previous July (something over three months before admission) the patient was accidentally shot. The weapon was a parlor rifle. The bullet, which was of No. 22 calibre, entered about the centre of the left popliteal space posteriorly and emerged anteriorly after passing through the head of the tibia. The knee-joint was not opened. The hemorrhage was moderately severe for a short time but soon ceased. The wound was dressed antiseptically and healed in a few days. A few hours after the accident the patient became conscious of a peculiar and annoying sensation in the popliteal space, which sensation has been continuously present ever since and has undergone a gradual increase. She describes it as a vibration or thrill that is like "feeling a roar." The thrill is and has been accompanied by marked pulsation, and both pulsation and thrill are growing more distinct every week. The patient has had no pain, although the leg has been and is weak. She has been wearing a rubber stocking because of swelling.

Examination on Entrance.—A small, depressed, white, irregularly circular scar is visible in the middle of the left popliteal space. A large and rather irregular cicatrix is noted below and to the outer side of the patella.

The leg and foot are a little swollen, somewhat œdematous, and decidedly pale when compared with the same parts of the

opposite extremity. The pulsation in the dorsalis pedis and the posterior tibial is very much weaker than in the corresponding vessels of the opposite side. The patient complains that the foot feels cold and it is distinctly colder to the examiner's touch than is the other foot.

The superficial veins of the leg and thigh are much enlarged and are tortuous but do not pulsate. The blood in the superficial veins flows in the normal direction. When the fingers are placed upon the surface over the popliteal space, a very distinct thrill is experienced. It is continuous and is characteristically the "purring thrill" described by Professor Matas and others. This thrill extends over an area from several inches above to several inches below the popliteal space, but is most marked over the middle of the space. It is most distinct at each cardiac systole. A murmur is heard on listening through a stethoscope. From the popliteal vessels a loud and continuous buzzing or purring murmur is heard, and this murmur becomes temporarily louder at each cardiac systole, that is to say, with each accentuation of the thrill. The stethoscope enables us to hear this murmur for several inches above the popliteal space and as low down as the ankle, but it is most marked over the popliteal vessels. When the thigh is raised to a vertical position, the thrill and murmur cease to be continuous and become appreciable only during cardiac systole. This observation accords with the observation made by Nélaton upon a case many years ago. Compression of the femoral artery in the thigh at once completely abolishes both thrill and murmur. There are no signs of trophic disturbance in the leg. The patient complains somewhat of aching, episodes of burning, and sensations of cold in the leg, and she walks stiffly and with difficulty. The pulse-rate is 70. Her general condition is excellent, and she is positive that the thrill is growing progressively worse. The condition is clearly one of arteriovenous aneurism.

[*Note to History.*—It is well known that a small percentage of cases of arteriovenous aneurism tend to spontaneous cure, but this event is too rare to be anticipated in any case, and it certainly is not to be anticipated when the signs of aneurism are growing worse instead of better. It is well recognized that many cases of arteriovenous aneurism last for years without causing grave danger or even serious annoyance. This statement, how-

ever, applies to the trouble when it arises in the neck and upper extremities, and is not accurate when we are speaking of the lower extremities.

In a lower extremity the lessening in the amount of arterial blood distributed to the parts below the aneurism and the increased impediment to the venous return produce sooner or later serious or even grave trouble from failing nutrition of the parts, and difficulties born of venous engorgement are almost certain to arise.

In view of the fact that in this patient an insufficient amount of arterial blood is being distributed to the periphery, that the veins are much engorged, and that the condition is not improving but is growing distinctly worse, it seems advisable to recommend an operation.]

Operation (October 22, 1910).—Five days after her admission and with the valued aid of my friend and colleague, Professor Francis D. Stewart, I operated upon Miss J. My intention was to open the vein by a longitudinal incision, suture the opening into the artery through the open vein, and then close the opening in the vein wall, but I was obliged to modify this plan by the developments during the operation. After etherization and with the patient supine, an Esmarch bandage was applied from the root of the toes to below the knee, at which point the band was applied and the bandage removed. After the extremity had been held for a time in a vertical position an Esmarch bandage was applied from above the knee well up upon the thigh, at which point the band was put in place and the bandage removed. The patient was then placed prone.

A longitudinal incision about six inches in length was made over the left popliteal space, and the vessels and the nerve were dissected free from the surrounding structures from above downward to the centre of the space. It was found that the vein and artery were directly fused somewhat below the centre of the space. There was no intervening sac. The artery distal to the point of fusion was small, but proximal to the same point was much dilated though not saccular. The vein distal to the point of fusion was very much dilated and much thickened. How far this thickening and dilatation extended could not be determined. The vein above the point of fusion was also enlarged and thickened. A longitudinal incision was made on the outer

side of the vein, the opening into the artery found and sutured. The suturing was effected by means of interrupted sutures of No. 0 iodized catgut passed vertically and like Lembert sutures. The longitudinal incision in the vein and the sutures passed about the opening in the artery are shown in Fig. 1.

On tying the sutures, it was found that so much of the vein wall had been drawn in by the stitches that the calibre of the vein was greatly lessened (Fig. 2). It was considered useless to attempt restoration of the vein by the method we had at first contemplated, therefore the vein was divided transversely on each side of the point of fusion to the artery, and this portion of vein wall was used as a flap and superimposed over the suture line in the artery and was sewed to the artery by catgut stitches (Figs. 3 and 4). Thus we used a flap of vein to strengthen the sutured artery at that point. The flap was about one inch in length. The two ends of the vein were then brought together. As the lower end of the vein was the larger, the upper end was invaginated into the lower end and fixed there by four catgut sutures. The junction was re-enforced by a few catgut sutures passed through the external coat of the vein at the line of junction. The tourniquets were removed and the blood jumped into both vessels. The blood in the vein was moving toward the body. The artery pulsated strongly and there was not a bit of leakage. Bleeding vessels in the popliteal space were caught and tied. The wound was closed by silkworm gut sutures and no drainage was employed. The knee was placed in a position of semi-flexion over pillows.

The patient made an uninterrupted recovery. A week after the operation the stitches were removed, and day by day the leg was straightened out a little. For a couple of weeks the leg swelled a little but never notably.

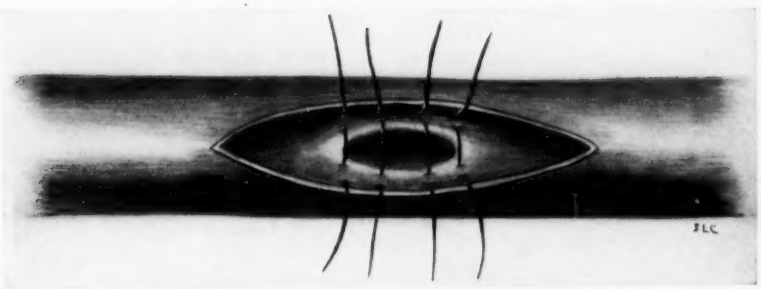
November 16: She was gotten up on crutches (a little over three weeks after operation).

November 24: She began to bear weight on the leg, still using crutches.

November 28: She left the hospital still using crutches as an aid.

A month after this she put aside the crutches and walked naturally. At the present time (October 20, 1911), which is a year and one month after the operation, she is in excellent con-

FIG. 1.

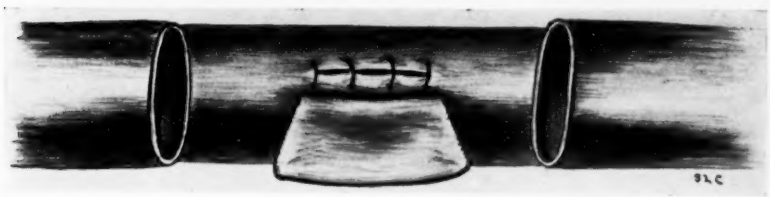


Longitudinal incision in the vein, and sutures passed through the margins of the arterial opening.

FIG. 2.

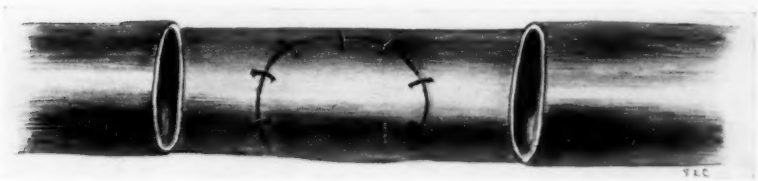
Sutures tied. Calibre of the vein greatly lessened by doing so (the diminution in calibre was more decided than is shown by the diagram).

FIG. 3.



Flap of vein left in place after transverse division of the vein at two points (the flap was larger than is shown by the cut).

FIG. 4.



Flap of vein sewed in place upon the artery so as to cover in and reinforce the sutures in the wall of the artery.

dition, and walks easily and comfortably. The leg is free from swelling, pallor, and sense of coldness. The pulse in the dorsalis pedis and posterior tibial of the damaged side seems to be as good as the pulse in the corresponding vessels of the sound side. The superficial veins are much smaller though still visible. It would seem that it is justifiable to regard this case as a complete cure.

The interesting points about this case are the following:

1. That the symptoms appeared within a few hours of the accident. We know that symptoms may appear at once or in a very few hours, but as a rule they do not appear until weeks or even months have elapsed.

2. That although this was a gun-shot wound there was no intervening sac between artery and vein. The condition was an aneurismal varix and not a varicose aneurism. Of course a sac may have been present but have shrunken up and disappeared, although the fact that only three months had elapsed between the injury and the operation makes such an event improbable.

3. That it was necessary to destroy the vein in order to suture the artery. Perhaps this destruction could have been obviated if the sutures through the arterial opening had been passed in the direction of the long axis of the artery instead of vertically. In another case I would not pass them vertically, that is, I would not pass them at right angles to the long axis of the artery, but would insert them in the long axis.

4. That the destruction of the vein clinically added to the safety of the arterial suture by allowing the surgeon to reenforce the first suture line.

5. That the end-to-end union of the vein was apparently followed by immediate, complete, and permanent restitution of the blood current.

6. That iodized catgut sutures and intestinal needles were used for the vein and the artery.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held at the Mt. Sinai Hospital, January 10, 1912.

The President, Dr. Charles L. Gibson, in the Chair.

CONGENITAL TERATOMA OF THE SUBMENTAL AND LEFT PAROTID REGIONS.

Dr. Arpad G. Gerster presented a male, otherwise well-formed infant, seven days old, the fifth child of a healthy couple and the result of a normal birth. Immediately after delivery it was seen to be disfigured by a grotesque swelling occupying the submental and pretracheal region. The tumor, which had the size and shape of a large orange, was attached to the under side of the chin, sending out an extension up to the parotid, temporal, and mastoid regions of the left side. Its integument was shining from tension, and underlying it a number of large veins were visible. It was freely movable, and palpation gave evidence of an extremely uneven consistency. A large portion of it was evidently cystic, as proven by the withdrawal of about four ounces of a thin, dark bloody serum, the remaining mass consisting of tissue giving the feel of a lipoma, in which there were disseminated a number of irregularly ovoid bodies of the hardness of cartilage and a number of cord-like bodies. The trachea, larynx, and hyoid bone were not connected with the mass. Crying did not cause a more marked cyanosis than that observed in the face; there was no pulsation nor erectility. The mass was looked upon as a mixed tumor belonging to the class of teratomata formed in fetal life, possibly complicated by a branchial cyst of the left side. The presence of an enlarged thymus gland could not be demonstrated.

The bloody removal of such a large tumor at this tender age was out of the question on account of the intolerance of infants

to the loss of blood. Bloodless methods were also dangerous on account of probable sepsis. Moreover, the presence of a hygroma in the centre of the mass offered an additional warning against active measures, but the principal objection to these lay in the attacks of dyspnœa—laryngismus stridulus—to which the infant was subject. An elder brother of this child had succumbed to a similar attack.

SADDLE-SHAPED ULCER OF THE LESSER CURVATURE OF THE STOMACH, WITH HOUR-GLASS DEFORMITY.

DR. GERSTER presented a woman, 27 years old, who was admitted to the Mt. Sinai Hospital on November 20, 1911, complaining of dyspeptic symptoms complicated by sharp epigastric pain, which had set in about three years ago. The pains radiated to the back and the left shoulder and provoked two or three daily attacks of vomiting, the rejected matter being very acrid, containing mucus and sometimes fresh blood. After persisting for eighteen months these symptoms ceased for three months, then returned with renewed severity. There had been one copious hæmatemesis before admission.

When the patient came to the hospital she weighed only 68 pounds and was extremely feeble and anæmic. The blood showed 55 per cent. of hæmoglobin. The abdomen was scaphoid, and in the left hypochondrium an extremely tender, fixed mass could be felt. Posteriorly there was an equally tender spot in the tenth intercostal space. Otherwise, all the internal organs were healthy. The diagnosis of a perforating ulcer of the stomach was made, the perforation being protected by previous adhesions. The use of the stomach tube was refrained from, and a methodical treatment for gastric ulcer was instituted by means of the administration of an alkali in the form of bicarbonate of soda, and frequent small doses of morphine, together with the application of an ice-bag over the tender mass. Nothing but water was permitted to be taken by the mouth for a number of days, nutrition being maintained by enemata.

Up to December 6 there was a steady diminution of hæmoglobin to 46 per cent., but the irritative symptoms having then disappeared, nutrition by the mouth (Lenhartz diet) was begun, which resulted in a rise of the hæmoglobin modulus by December 13 to 62 per cent. Three days prior to this, after the adminis-

tration of a large dose of unmixed carbonate of bismuth, a radiograph was made to locate the ulcer rather than for any other purpose, the intention being to resect the ulcer. Up to this time, in fact until a laparotomy had disclosed the true status of affairs, no thought was given to the possibility of the presence of an hour-glass stomach. There were no rational symptoms to awaken suspicion, and the use of the stomach tube was purposely eschewed.

The radiographs showed an irregular, scanty deposit of bismuth carbonate near the lesser curvature, but gave no other intimation. On December 14, a laparotomy disclosed the presence of a typical hour-glass stomach. The left lobe of the liver was closely adherent to the lesser curvature along the latitude of the line which divided the fundus from the antrum pylori, and, welded together with the stomach wall, presented a dense, hard mass, corresponding to a saddle-shaped ulcer of the latter organ. At the site of this ulcer, the larger curvature was drawn up very close to the lesser, this tight constriction dividing the stomach into two uneven loculi: a larger one, consisting of the fundus, and a lesser one, representing the antrum pylori. The stoma connecting the two loculi was close to the lesser curvature, and barely permitted (by invaginating the anterior gastric wall) the entrance of the tip of the index-finger. Without disturbing the region of the ulcer—so well protected by the adhesions to the liver—a suture anastomosis was established between the two loculi of the stomach. Following this, food was withheld by the mouth for three days; then oral nutrition was begun with liquids, buttermilk, broth, orangeade, and diluted claret, and by December 19 with pea soup, cocoa, and milk-shake with egg. A constant hunger demanded great care against imprudences which the patient was ready to commit. By January 6, 1912, she had gained ten pounds in weight, and she is now gaining at the rate of one pound per day on a liberal and mixed diet. The radiographic plates, taken January 9, beautifully illustrated the distribution of the bismuth paste in the two gastric loculi, together with the new stoma established by operation.

Dr. William A. Downes said that about two and a half years ago he showed a patient at a meeting of this Society upon whom he had done a gastrogastrostomy for a condition very similar to that described by Dr. Gerster. In his case he had found the stomach adherent to the left lobe of the liver, and no attempt

was made to separate this attachment. Dr. Downes had operated upon the case two years before for acute perforating gastric ulcer, and she had remained well for one and a half years. This patient had suffered from periodical attacks of vomiting, with pain, and high acidity of the gastric contents, together with great loss of weight, which had since been regained. She is now perfectly well.

Dr. Howard Lilienthal said that in one of his cases where the symptoms led him to believe that he had to deal with an hour-glass stomach, an operation failed to reveal that condition. In that case he did a gastro-enterostomy and cured the patient. The speaker said that in trying to recognize this condition, the Röntgenologists did not trust the skiagraphs, but depended upon fluoroscopy, watching the stomach while in action.

Dr. Charles H. Peck said he had seen two cases of hour-glass stomach, one of which he had operated on last summer, four years after an operation for perforated gastric ulcer. In that case he did a gastrogastrostomy with very satisfactory results, the patient having no return of the symptoms. In a similar case, a year earlier, the operation of gastro-enterostomy in the proximal pouch was followed by very unsatisfactory results, as it gave the patient only temporary relief.

ARTIFICIAL INGUINAL HERNIA PRODUCED TO CAUSE EXEMPTION FROM MILITARY SERVICE.

Dr. Gerster presented a man, 43 years old, a baker and a native of Austrian Poland, who 23 years ago submitted to a procedure which, for the payment of fifty florins, resulted in the acquisition of a hernia. The modus operandi was as follows: The patient, at night and blindfolded, was taken to a strange address, where he was laid supine on the floor and was held there securely by confederates of the operator, who was a woman, probably a midwife. With increasing force she insinuated first one, then two and if possible three fingers into the inguinal canal, divulsing it as far as possible. This accomplished, the victim was permitted to rise and was given, sometimes a vomitive, but regularly an irritant and powerful snuff, to be used until a visible hernia was produced. The original fee was generally augmented by repeated exactions in the nature of blackmail, to which the patient submitted as an alternative to imprisonment.

In the case shown by Dr. Gerster, the hernia, originally a

bubonocele, had within the last four months descended into the scrotum; it had formed numerous adhesions to the sac, had become irreducible and painful, and was the cause of frequent attacks of colicky pain.

On admission to the Mt. Sinai Hospital, on November 29, 1911, the left side of the scrotum presented a mass the size of a cocoanut, the contents of the sac being non-tympanitic, irreducible, and painful to the touch. The inguinal canal easily admitted the tips of three fingers. On December 5, 1911, a modified Bassini hernioplasty was done. Most of the large omentum was in the sac, the distal parts of which were firmly adherent to its bottom. There were also close adhesions to the peritoneal lining of the neck of the sac. These being liberated by dissection, the mass was withdrawn and spread out to permit the application of a series of ligatures in the manner of a lock-stitch, and the mass was then ablated with the actual cautery distally to this series of ligatures. The portion of the fundus of the sac adherent to the distal parts of the omentum was extirpated in one piece with as much of the sac as was not needed for the application of the purse-string suture by which the peritoneum was closed.

After the peritoneal stump was retracted, the epigastric vessels were seen freely traversing the hiatus, thus demonstrating the fact that a condition which united the characteristics of an oblique and of a direct hernia was being dealt with. Evidently, the transversalis fascia had borne the main brunt of the traumatism.

Better to secure the patient against a relapse, the conjoined tendon, together with the external oblique aponeurosis, were stitched as deeply down as possible on the inner aspect of Poupart's ligament; then the free, redundant edge of Poupart's ligament was lapped over the cord and was stitched again to the outer surface of the external oblique aponeurosis. Primary union ensued, and to-day the patient reported not only perfect comfort, but, as a gratifying by-product, the reappearance of his lost sexual potency.

Dr. William B. Coley said that in an article on "Artificial and Traumatic Inguinal Hernia" (*Arch. f. klin. Chir.*, vol. xci, Hft. 3, 1910) Krymow pointed out that the former, which were produced by a special kind of "operators," were observed in

Russia only, and exclusively in persons who wished to evade military duty, mainly Hebrews, for, he added, the life of a Hebrew soldier was not an enviable one.

The question of artificial hernia had a three-fold significance: first, social and national; second, medicolegal; and, third, scientific, inasmuch as a study of the methods employed for the artificial production of a hernia might, at the same time, solve the question of the etiology of inguinal hernia.

Krymow described his experiments upon the cadaver for the production of artificial hernia, and stated that he succeeded in producing the same by tearing the aponeurosis and the transverse fascia. This might be easy or difficult, according to the size of the external ring and according to the strong or flabby condition of the fascia. A stout muscular layer might prevent the passage of a hernia, even though the fascia be torn. In the cadaver, a long-continued pressure was sufficient to produce a hernia. He reported five cases of his own, three of which were artificial and two traumatic, and on the basis of these, as well as other cases found in the literature, he divided traumatic inguinal hernia as well as the artificial into two categories: to the former (the majority) belonged such herniæ as were due to an injury above the external ring and in which the ring itself remained intact; to the second category belonged such cases in which the injury involved and destroyed the external ring. Artificial and traumatic herniæ that had developed after a rupture of the abdominal wall above the external ring could not be differentiated; the physical as well as the objective signs were the same.

Dr. Coley said he had seen a number of cases of artificial hernia at the Hospital for the Ruptured and Crippled.

Dr. Parker Syms said he had seen a number of cases of artificial hernia, and that he had reported some of them at one of the meetings of this Society. In the production of this form of hernia, he had been told that the administration of an emetic to cause violent vomiting was a part of the treatment.

COMPLETE EXTIRPATION OF THE COLON FOR PAPILLOMATOUS DISEASE (TWELVE YEARS AFTER OPERATION).

Dr. Howard Lilienthal presented a patient whose case was originally reported by him in *American Medicine*, April, 1901. The patient was a girl, 21 years old, when she was referred to

the surgical department of Mt. Sinai Hospital by Dr. Morris Manges. She had for years suffered from diarrhœa, accompanied by hemorrhages and the passage of foul mucus, and she finally became so weak and anæmic that a left inguinal colostomy had to be done to give rest to the lower portion of the colon and rectum. The surgeon who opened the colon at that time saw that the walls of the viscus were covered with polypoid growths which bled easily even on gentle manipulation.

The patient was very much benefited by the operation, the hemorrhages finally ceasing, so that it was thought best to close the artificial opening. No sooner had she left the hospital, however, then her old trouble returned in all its severity, and she once more became profoundly anæmic and very weak. At this time, when Dr. Lilienthal first saw her, she had as many as twelve stools a day. There was much abdominal pain and some vomiting. The diarrhœa and bleeding were worse after the ingestion of certain articles of food, and she could not eat meat at all. On examining the abdomen, considerable tympanites was noted, but no distinct mass could be felt. Examination of the rectum disclosed the presence of several small polypoid masses. On account of the inability of the surgeon at the previous operation to reach the upper limits of the disease with the finger through the original colostomy wound, Dr. Lilienthal determined to open the caput coli through a wound in the right iliac region in order to give the entire colon as thorough functional rest as possible. This operation was done on December 30, 1899. He found the colon here in much the same condition that had been noted in the descending colon. There was no normal mucous membrane, the entire mucosa being covered by large and small papilloma-like excrescences. One of these was removed and submitted to Dr. F. S. Mandlebaum for pathological examination, and proved to be an hypertrophied solitary follicle. Incidentally, the vermiform appendix was removed at this time. Its mucosa was hyperplastic. Without going into the details of the treatment, the speaker said that everything which to his mind promised success was tried—nitrate of silver injections and irrigations, saline irrigations, etc. The patient's general condition rapidly improved. The hemorrhages ceased almost entirely, but it was evident that the closure of the right colostomy wound would surely be followed by the recurrence of her trouble, since the

condition of the visible mucous membrane was unchanged. He therefore made up his mind that the exclusion of the entire colon from the alimentary tract promised the greatest relief with the least degree of risk. Accordingly, on March 6, 1900, the operation of an end-to-end ileosigmoidostomy was performed. Through a median incision the ileum was sought out and divided about four inches from the ileocæcal valve. The intestine here was observed to be healthy. The lower end of the ileum, that adjoining the ileocæcal valve, was closed by invagination with the help of a purse-string suture of silk. The sigmoid flexure was then drawn into the wound, and was in turn divided somewhere in its lower half, its upper portion being also invaginated by means of a heavy purse-string suture. The lower portion of the sigmoid was then united by Murphy's button with the upper portion of the ileum, so that the intestinal contents would pass directly from the ileum into the lower half of the sigmoid flexure, which was comparatively healthy. A drainage wick was left in the lower angle of the wound, the remainder being closed by sutures. The right iliac colostomy was, of course, not disturbed, because it was understood that a vent for the secretions of the excluded portion would be necessary. Following this operation, the patient was kept quiet with opium. Full stimulation was necessary, as there was considerable shock. The urine on March 10 showed the presence of albumin and casts. The patient was then having numerous small, involuntary liquid stools. There was a large amount of exceedingly foul discharge from the right iliac wound, and it was necessary to wash out the excluded colon several times a day with a long rubber tube passed as far as possible into the lumen of the gut. On March 19 the Murphy button was extracted from the rectum with forceps. The patient's general condition at this time was greatly improved, although she still had ten or fifteen stools a day. On March 26 the number of stools had fallen to about nine per day. Dr. Lilienthal said that at this time he was surprised to learn that irrigation through the colostomy wound seemed to act as an enema, the patient insisting that the water injected through this wound was passed by the rectum. Irrigations with methylene blue showed that this was the case. At first he could scarcely believe such a thing possible, but afterward came to the conclusion that a tract of suppuration must have formed between the site of the

anastomosis and the invaginated end of the sigmoid. It certainly was an example of the wonderful way in which nature tried to re-establish normal conditions.

The patient now rapidly improved. The discharge from the colon became less and less, and the visible mucous membrane of the colon in the right iliac region had been cauterized, using the Paquelin cautery, with the hope of causing the formation of cicatricial tissue so that there would be no annoyance from the wet, everted mucous membrane. The patient insisted, however, that she would not be satisfied until the opening was closed. Knowing that the only way which promised success would be the total extirpation of the colon and stump of the ileum, Dr. Lilienthal hesitated to gratify her wish. Still, on considering the matter, he believed that this operation might, after all, be feasible, in view of the fact that the colon was already so to speak out of commission. Then, too, the mucous membrane had not atrophied, and still bled at the slightest touch, so that he was obliged to consider the probability that it would become the seat of malignant degeneration.

He therefore consented to operate once more, and on June 15, 1900, made a median incision at the site of the old scar. The first point sought out was the region of the anastomosis between the ileum and the sigmoid. He found here a fibrous cord, over an inch long, connecting the invaginated end of the sigmoid with the point of anastomosis. On dividing this, a central channel was found which explained the appearance of the methylene blue solution in the stools after its injection into the colon. This cord was cut off flush with the anastomosis, the place was inverted into the intestine, and the opening closed with a few Lembert sutures. The line of the button anastomosis was very perfect, and there was no induration. Beginning now at the sigmoid flexure, numerous ligatures were passed through the mesocolon, the extirpation coincidently proceeding. The patient's condition became somewhat critical, and in order to save time he was obliged to take large masses in the grasp of each ligature. At a distance of about two and a half inches from the colostomy wound he cut off the colon and removed it from the abdomen. A long forceps was now inserted from without through the colostomy wound, and the end or stump of the colon was grasped and withdrawn, thus everting the stump. He then tried to treat

the stump of the ileum, which had shrunk to about two and a half inches, in a similar manner, but was unable entirely to evert it. With one hand in the abdomen he guarded against possible protrusion or prolapse of a loop of intestine into the funnel of the everted colon. At the same time he ligated with a piece of silk the entire everted stump, cutting away the external redundancy. The median incision was now closed by sutures, a gauze drain being left in its lower angle and another passed down to the right flank, where there had been some bleeding.

The patient reacted well after the operation, but on the following day she developed a pneumonia of the lower right side, which yielded to treatment. There must have been infection at this operation, for an abscess formed beneath the median wound through which foul-smelling pus and apparently fecal matter, but no gas, escaped. On the fourth day there was a distinct fecal discharge from the right iliac wound, the ligature having come away. Dr. Lilienthal could only account for the appearance of fæces at this point by assuming the prolapse of a knuckle of intestine which was strangulated by the tightening of the ligature. On June 27 there occurred a spontaneous rupture of a large abscess at the site of the old colostomy wound, the evacuation of the pus being accompanied by the discharge of a piece of gangrenous mesocolon, with five or six chromicized catgut ligatures still in place upon it.

All the wounds finally healed with the exception of the fistula in the right side. Realizing that this would not close without another operation, he excised the entire cicatrix and fistula on October 6, expecting naturally to come upon the loop of small intestine which it was his intention to excise, anastomosing the ends. To his astonishment he found a single piece of intestine, not a loop, passing directly to the fistula. A large probe passed in at the fistula was seen traversing the lumen of this intestine. The intestines were matted together in many places, but it was possible to explore easily for fully ten inches along this gut without encountering adhesions. Knowing that the patient had passed but a very small portion of the daily quantity of fæces through the fistula, he merely cut off this piece of intestine and invaginated it and then closed the wound by suturing, with drainage.

The subsequent course of the patient was most gratifying.

All the wounds were now closed, and at the present time, twelve years after the operation, the patient was in excellent general health. The stools, which were of normal consistency and form, were limited to one or two a day, the patient sometimes requiring mild laxation. An X-ray taken in January, 1912, by Dr. Jaches disclosed a dilated condition of the stump of sigmoid which acted as an ample reservoir. The ileocolostomy was plainly visible.

LANE'S KINK OF THE ILEUM.

Dr. Lilienthal presented a man, 25 years old, who was admitted to the Mt. Sinai Hospital on July 9, 1911, with the history that for the preceding year he had suffered from an intermittent pain in the right lower abdomen, with occasional vomiting. He also complained of hemorrhoids and constipation. The case was regarded as one of chronic appendicitis, and on July 10, 1911, the abdomen was opened and the appendix removed. Upon further exploration it was found that the right border of the omentum was attached along the entire border of the ascending colon and cæcum. The appendix had been found bent downward and backward beneath the caput coli; the base of the appendix, for a distance of about an inch, was of the usual size, but at that point it tapered into a slender cord-like structure to its extremity, a distance of about two inches.

About three inches from the ileocæcal valve the ileum was found sharply angulated by a distinct mesenteric fold, extending downward. This, as well as the omental attachment to the ascending colon, was divided, and the patient left the hospital on July 31. He returned on August 9 complaining of pain in the right iliac fossa, together with constipation. He was kept under observation, and on October 17, 1911, the abdomen was reopened, and upon exploration, firm adhesions were found at the ileocæcal junction. These were separated. The patient left the hospital on November 2, and had since remained free from symptoms.

LAMINECTOMY FOR EXTRAMEDULLARY TUMOR OF THE SPINAL CORD.

Dr. Charles A. Elsberg presented a woman from whom he had removed a glioma of the dorsal cord. When the patient was first seen she complained of nothing excepting pain on the

right side of the abdomen. She had been under treatment for a number of months for this pain, but without benefit. Careful examination showed that she had sensory and motor disturbances in the lower limbs, and that the pain was a root pain of the twelfth dorsal nerve-root. A large extramedullary tumor was removed by Dr. Elsberg after laminectomy and incision of the dura. The right twelfth dorsal root was found tightly stretched over the tumor. The patient made a good recovery, and was now perfectly well and free from all symptoms.

LAMINECTOMY FOR INFILTRATING TUMOR OF THE SPINAL CORD.

Dr. Elsberg presented a man from whom he had removed a tumor of the cauda equina. He gave a history of pain in the sacral region, with increasing loss of power in the lower extremities. He had the characteristic symptoms of absence of knee- and ankle-jerks, double drop-foot, reaction of degeneration in the peronei, and irregular sensory disturbances in the lower limbs. The tumor was a large endothelioma around the nerves of the cauda equina, and was removed in two stages.

Dr. Elsberg, in connection with these cases of spinal tumor, presented a number of specimens of tumors of the spinal cord which had been removed by him during the past two years. Four tumors were very large growths removed from around the nerves of the cauda equina, and the speaker made especial reference to the fact that the endotheliomata of the cauda equina presented a very characteristic clinical picture that should be recognized early. He also showed specimens of extra- and intramedullary growths of the spinal cord that he had removed by operation, and laid special stress upon the importance of the early recognition of spinal new growths. With early operation, the results should be excellent. He considered a laminectomy, done on a patient in good condition, as a not very dangerous operation.

Dr. George Woolsey said he would like to hear from Dr. Elsberg how he had determined that the first case shown here about a year ago was an intramedullary tumor, for at the time he first showed it he was doubtful about it. Dr. Woolsey asked this because in two or three of the cases on which he had operated it was difficult to determine the origin of the tumor. The cord appeared enlarged and on incision several layers were divided

before the tumor was exposed, and it was difficult to say whether the tumor was derived from the pia arachnoid, was subpial, or perhaps intramedullary.

DR. ELSBERG, replying to Dr. Woolsey, said that after the dura was incised he found an enlarged cord surrounded by pia. After dividing the latter, the cord surface could be distinctly made out, and it was necessary to make an incision into it of at least 2 to 3 mm. in depth before reaching the tumor itself. The growth lay there, imbedded in the cord tissue and perfectly visible to the eye. In other cases, where the tumor sprang from the pia arachnoid and extended inward, the differential diagnosis between extra- and intramedullary growths was more difficult.

With regard to tumors of the cauda equina, Dr. Elsberg said he had reached the conclusion that they did not originate from the dura. In at least half of the cases he had seen, the cauda lay on top of the tumor. He was not prepared to say where these growths did originate.

RESECTION OF THE COMMON DUCT FOR CARCINOMA.

DR. ALEXIS V. MOSCHCOWITZ presented a woman, 48 years old, who was admitted to the medical service of the Mt. Sinai Hospital on November 5, 1911. For four months prior to that time she had been suffering from indefinite gastro-intestinal symptoms, chiefly characterized by pain which had its onset a few minutes after the ingestion of food and lasted for three or four hours. The pain was cramp-like in character and radiated backward to the spine.

Physical examination revealed a painful and tender mass in the region of the gall-bladder and a slightly enlarged liver. Upon admission to the hospital the patient was not jaundiced, but shortly afterward icterus appeared and rapidly increased in intensity, so that when she was transferred to the surgical side of the hospital, in the service of Dr. Gerster, she was of a deep, bronze color. For three days preceding the operation there were rigors, with high temperature.

Operation, November 26, 1911, by Dr. Moschcowitz: Upon opening the abdomen, a large, tense, acutely inflamed gall-bladder was found, containing over 300 calculi. In addition, there could be palpated in the fundus of the gall-bladder a nodule, about the size of a marble, the exact nature of which could not

be made out at the time. The liver was much enlarged, but otherwise was apparently normal. A cholecystectomy was decided upon, and as he was preparing the cystic duct for the purpose of deligation (with perfect exposure and without any undue trauma) he suddenly perforated into the exceedingly brittle common duct, which he found filled with tumor tissue.

Despite a strong disinclination to perform so formidable an operation upon a more than precarious patient, he was forced to proceed. After mobilizing the duodenum, he exposed the common duct up to the point where it entered the head of the pancreas, and divided it. Its proximal end was also divided through apparently healthy tissue, and lay just at the hepaticocystic junction. A T-tube drainage was established, one end of the transverse part of the "T" being inserted into the hepatic duct and the other into the distal part of the common duct. Because of tension, he was able to introduce only two chromicized catgut sutures to reconstruct the posterior part of the common duct, while the anterior section of the duct was reconstructed out of the hepatoduodenal ligament and duodenum. The fundus of the gall-bladder (including the nodule previously mentioned) and about one-half of the gall-bladder were now extirpated, and a tube was introduced into the cystic duct and fastened by purse-string sutures. The external incision was closed in the usual manner.

There was very little drainage through the tubes; not more than 15 c.c. on an average per day, but there was considerable drainage along the sides of the tubes. The patient's jaundice soon began to fade and disappeared entirely within ten days after the operation. There were no post-operative complications whatsoever. On the fifteenth day the tube in the cystic duct was removed, and ten days later the T-shaped tube was removed also. Bile was found in the fæces from the first day after the operation, the stools previously having been absolutely acholic, and while the fæces even at the present time were deficient in the bile content, they were fairly well colored. The patient continued to discharge large amounts of bile through the fistula, though it was gradually diminishing in quantity, and the proper course of procedure was now under consideration, providing the fistula did not close.

Dr. Moschcowitz said that from his knowledge of the case

he felt confident that he could do a hepaticoduodenostomy, provided he found, upon exposure, that there was no recurrence of the growth, which, as well as the nodule in the gall-bladder, were pronounced by Dr. Mandlebaum to be carcinoma.

Dr. Parker Syms said he recently had a case of common-duct obstruction with a sinus leading from this duct to the skin. This sinus had followed an operation for removal of a gangrenous gall-bladder with drainage of the duct. This sinus was composed of fibrous tissue, and an interesting point is that it was such a definitely formed structure that it could certainly have been used to make an anastomosis with the intestine. However, this procedure was not resorted to. A large stone was removed from the duodenal end of the common duct and the sinus was resected and closed.

Dr. Lilienthal, discussing Dr. Moschcowitz's case of resection of the common duct, suggested the use of a rubber tube, with the expectation that a sinus would form and that the tube would then be extruded. He certainly thought it worth while to make a further attempt in this case.

Dr. John A. Hartwell said that experiments of this kind had been done on dogs.

Dr. Gerster said that a similar procedure was employed by Dr. Brewer. He used a rubber tube which he surrounded with omentum.

Dr. Gerster said that of all the plans that had been suggested, he thought the one mentioned by Dr. Moschcowitz, namely, to join the hepatic duct direct to the small intestine, was the most feasible. This had been done successfully in France, and the procedure deserved more attention than it had hitherto received.

CHOLECYSTECTOMY, DUODENORRHAPHY AND GASTRO-ENTEROSTOMY FOR CHOLECYSTODUODENAL COMMUNICATION.

Dr. Moschcowitz presented a woman, 40 years old, and a native of Austria, who was referred to him by Dr. Bernard Weiss on January 10, 1911. Twenty-two years ago she had had for the first time an attack of pain in the right hypochondrium. A year later she had a particularly severe attack, accompanied by jaundice of a few days' duration. Since that time there had been numerous attacks, particularly during her various (eight) pregnancies, but with the exception of the second attack already

mentioned, jaundice was not noted. For the past fifteen months the patient was ailing continuously, her chief complaint being pain in the right hypochondrium, radiating to the right shoulder. There was also loss of appetite, flesh, and strength.

Physical examination revealed the presence of a tumor about the size of a goose-egg, of stony hardness, occupying the region of the gall-bladder. There was also a small umbilical hernia, and the patient was three months pregnant.

Operation, January 12, 1911: An incision, four inches long, was made through the upper part of the right rectus. The gall-bladder, about the size of a goose-egg, was found imbedded in omentum, to which it was densely adherent, as well as to the descending portion of the duodenum. The adhesions were gradually separated, and a communication, about the size of a silver quarter, found between the gall-bladder and the descending portion of the duodenum. The literally stony hardness of the gall-bladder was caused by innumerable small and large calculi, tightly packed together into one solid mass. It was rather surprising that the gall-bladder did not evacuate itself in view of the large communication between the gall-bladder and duodenum.

After extirpation of the gall-bladder, the perforation in the duodenum was closed by an inverting chromicized catgut suture, reinforced by Lembert-Pagenstecher sutures. As this encroached too much upon the lumen of the duodenum, a posterior retrocolic gastro-enterostomy was rapidly done by means of a Murphy button.

The post-operative course was a rather stormy one. There was a slight pneumonic infiltration of the lower lobes of both lungs, which was probably the cause of some febrile reaction, but after the third day the temperature was practically normal. Of more importance was the uncontrollable vomiting which set in after the operation, and continued to such an extent that the patient was literally starving. Various factors were considered in connection with this vomiting, such as her pregnancy, the umbilical hernia, acidosis, etc., but none explained it fully and satisfactorily. Postural treatment and frequently repeated lavage ameliorated but did not entirely overcome the vomiting for some time. Gradually she began to regain her weight, which had fallen to 65 pounds, and she was discharged on February 2, 1911, with a small sinus which was discharging bile-stained fluid.

The patient was readmitted nine days later, having aborted in the meantime. No curettage was indicated, but the vomiting and a profuse biliary discharge again set in. These symptoms, under the conscientious care and nursing which she received in the ward, gradually abated, and she was finally discharged, on April 13, in very fair condition. At the present time she is in excellent health; in fact, she weighs more now than she ever did before in her life.

In connection with this case, Dr. Moschcowitz exhibited a series of X-ray plates, taken April 1, 1911. These showed a normal stomach outline, both as to size and shape, but in the middle of the greater curvature there appeared to be a break in the regularity of the outline, and part of the bismuth gruel was seen in the small intestine about five minutes after ingestion, showing an abnormal communication (gastro-enterostomy) between the stomach and small intestine.

GASTROMESENTERIC ILEUS FOLLOWING A CHOLECYSTECTOMY.

Dr. Moschcowitz reported this case and showed the specimen, which was obtained from a woman, 34 years of age, who was operated upon by him on July 11, 1911, for a calculous empyema of the gall-bladder. The operation consisted of a cholecystectomy, which was unusually simple, the operation barely occupying 25 minutes. For three days she did perfectly well; there had been no untoward symptoms, and he practically considered her out of danger. Above all, he wished to emphasize that there had been no vomiting; nothing excepting the usual post-operative nausea which ceased a few hours after operation.

On July 14, three days after the operation, he was called to see the patient, who had gone into collapse, became cyanosed, with a rapid and thready pulse and distention of the abdomen. On searching for the cause of this condition, there appeared to him at the time only two possibilities: either a slipping of the ligature from the cystic artery, with secondary hemorrhage, or a slipping of the ligature from the cystic duct, with leakage of bile and the development of a fulminating peritonitis.

The patient was anæsthetized and the wound reopened. Everything at the site of the operation was clean and in perfect condition. To the left of the incision there presented an enormous loop of intestine which it was at first difficult to recognize,

but which revealed itself to be the enormously distended duodenum. Soon thereafter the stomach came into view, distended so as to cover practically all of the intestines. A stomach tube was now inserted, and 76 ounces syphoned out. As a considerable part of the stomach contents was lost, Dr. Moschcowitz said he had no hesitancy in stating that the stomach and duodenum held at least 100 ounces. After this, the patient immediately began to improve; the pulse became stronger, and the cyanosis disappeared. The question of a gastro-enterostomy was considered, but the patient's condition did not warrant it; besides, it was not deemed necessary.

Subsequently, with appropriate postural treatment and lavage, the patient improved and her condition looked encouraging. On July 22, however, eight days after the second operation, she again went into collapse and died a few hours later.

A very thorough post-mortem examination revealed in the fresh state an enormously dilated stomach, its greater curvature hanging down to the symphysis, and the entire duodenum was similarly dilated. This dilatation ended abruptly at the point where the superior mesenteric artery crossed the duodenum, the artery standing out like a whip-cord. Below this point the small intestines were collapsed.

Dr. Moschcowitz said there had been much discussion recently as to what was the primary condition in these cases of gastromesenteric ileus, and he believed that this case went a long way toward proving the theory of compression of the duodenum by the superior mesenteric artery.

Dr. John A. Hartwell said he did not think the case reported by Dr. Moschcowitz offered sufficiently strong evidence in proof of the fact that the dilatation of the stomach and upper duodenum was due to compression by the mesenteric artery. It was possible, he thought, that this constriction by the artery was secondary to the enormous dilatation and resulting gastroptosis.

In a case recently under his observation, Dr. Hartwell said, he accidentally produced a severe hemorrhage while ligating some of the arteries of the thyroid gland. In attempting to check the hemorrhage, the pneumogastric nerve was injured, resulting in acute dilatation of the stomach and death. At the autopsy, the stomach contents measured four litres, it was very much distended, and upon lifting it up, it was found that the

mesenteric artery had already produced a slight groove over the surface of the distended duodenum. In this case the dilatation had existed only a short time.

Dr. Hartwell believes the dilatation of the stomach to be primarily due to a paralysis of the musculature and the pressure on the duodenum by the mesentery to be a secondary result.

Dr. Henry H. M. Lyle said that in connection with the specimen shown by Dr. Moschcowitz he wished to refer to a case of acute dilatation of the stomach which was reported originally in the *New York Medical Journal* for November 4, 1911.

The patient was operated on by Dr. Lyle on July 21, 1908, for a large right inguinal hernia, the operation being done under local anæsthesia. The combined infiltration and intraneural method was employed, three-quarters of a grain of novocaine was used. The hernia had descended into the scrotum and contained a large amount of omentum. In order to reduce the hernia and guard against a future recurrence, it was decided to remove the redundant portion of the omentum. This was carefully done, causing the patient no discomfort. The mass removed weighed four pounds and two ounces. The hernia was repaired according to the Bassini method. The patient was returned to the ward in excellent condition. He was allowed some tea and toast, which is the routine for cases which have been operated on under local anæsthesia. About one hour later, the patient began to complain of pain and distention in the epigastric region. The usual carminatives, enemata, and stupes failed to give relief. The patient vomited a large quantity of brown, watery, colored fluid; this gave some temporary relief; then the distention began to increase rapidly. The lower border of the stomach seemed to be about three inches below the umbilicus. The patient became extremely restless, with a rapid running pulse of 135 to 150, and soon passed into a condition of partial collapse. Repeated stomach washings, combined with postural changes, gave temporary relief, large amounts of fluid and great volumes of gas escaping.

Eight hours after the initial attack, the lower border of stomach was thought to be in the right iliac fossa. Next morning the distention began to decrease, and all the acute symptoms disappeared within the following 48 hours. With the decrease of the distention, the patient's condition soon returned to the nor-

mal. He was discharged from the hospital four weeks later, and cautioned to remain under observation, as the hernia scar had been put to a very severe test.

Within a short time the hernia recurred. He was readmitted to the hospital and the hernia repaired under ether anæsthesia. The smooth recovery following this operation was in marked contrast to the stormy convalescence of the previous one.

This case shows a possible cause of acute dilatation. In all probability the removal of so large a portion of the omentum profoundly altered the circulation and possibly the nervous mechanism of the stomach, thus causing a temporary muscular paralysis. One cause that is sometimes given for this condition can be ruled out, viz., the toxic action of ether or chloroform on the stomach, and also the factor of rough handling of the intestines and stomach. The operation was done under local anæsthesia, and great care was taken to avoid all unnecessary handling and traction. There was no dragging on the omentum.

Dr. Moschcowitz, in closing the discussion, said his patient did not vomit. In spite of the fact that the stomach held at least 100 ounces, there was no vomiting; it was the lack of this symptom which entirely misled him, and in consequence of which he had not the least inkling of the true condition.

Replying to Dr. Hartwell, the speaker said he was led to believe that the compression of the duodenum by the mesenteric artery was the chief factor of the dilatation in this case because the distention stopped sharply at the point where the artery crossed the gut. Beyond that the intestines were collapsed.

Stated Meeting, held at the New York Hospital, January 24, 1912.

The President, Dr. Charles L. Gibson, in the Chair.

LINITIS PLASTICA: GASTRO-ENTEROSTOMY.

Dr. Alexander B. Johnson presented a case of linitis plastica in which the symptoms were relieved by a posterior gastro-enterostomy. The patient was a man, 35 years old, who had enjoyed good health until 18 months ago, when he began to suffer from severe epigastric pain, which usually came on about an hour after taking food and was relieved by vomiting. He

had never vomited blood, nor had any tarry stools been observed. During the past year he had lost 30 pounds in weight, and had grown weak and emaciated. Visible peristalsis was present for a week prior to his admission to the hospital.

Physical examination was practically negative, with the exception of some epigastric tenderness. A chemical examination of the gastric contents showed four ounces recovered from a fasting stomach, and 18 ounces after an Ewald test meal. The contents were negative for free hydrochloric acid, blood, and yeast.

After a posterior gastro-enterostomy the patient made an uneventful recovery, and left the hospital 22 days after the operation. Since then he had gained 22 pounds in weight and was able to eat practically anything.

Dr. Henry H. M. Lyle said that in the generalized form of linitis plastica, the stomach might be normal in size, dilated, or contracted; contraction was the rule, dilatation the exception. From Dr. Johnson's description and from the subsequent history of the case, it seemed probable that this was an instance of the dilated form.

The interesting point about these cases was the question of the correct surgical procedure. In his own case, Dr. Lyle said, he did a gastro-enterostomy but this was done in ignorance of the true nature of the condition. A study of the literature showed that it was practically impossible to make a diagnosis between this lesion and scirrhous cancer, so we were morally bound to perform a gastrectomy, providing the technical conditions were satisfactory.

Dr. George Woolsey said that in one case similar to that shown by Dr. Johnson where he was called upon to operate he did a gastro-enterostomy, and the patient, apparently, regained his health. Within two years afterward, however, he died from carcinoma of the stomach. This corroborated the statement made by Dr. Lyle that in many of these cases we had to deal with some form of carcinoma.

CARCINOMA OF THE BREAST, WELL 22 YEARS AFTER FIRST OPERATION AND 13 YEARS AFTER LAST OPERATION.

Dr. Frank W. Murray presented a woman who first came under his observation on September 3, 1889, at St. Luke's Hospital. In the upper and outer quadrant of the left breast there

was then a tumor, about three inches in diameter, of stony hardness, nodular, and adherent to the overlying skin. It was non-adherent to the pectoral muscle. The axillary glands were apparently enlarged. On September 5, 1889, the breast was removed, together with the enlarged axillary glands, and two weeks later the patient was discharged from the hospital, with the wound healed.

On November 5, 1889, she was readmitted to St. Luke's Hospital. At the centre of the scar of the former operation there was a hard, tender lump, about the size of a horse-chestnut. This was removed through a wide, elliptical incision, and a week later the patient left the hospital with the wound healed.

The patient was not seen again until May 16, 1898. At that time there was a hard mass, about an inch and a half in diameter, in the left supraclavicular space, adherent to the trapezius muscle and the surrounding tissues. Through a four-inch incision along the anterior edge of the trapezius muscle, the mass of enlarged glands, together with a portion of the muscle, was removed. Twelve days later the patient left the hospital with the wound healed.

The patient was next seen in 1903, when she was apparently well, without any signs of recurrence. Since then she had been under Dr. Murray's personal observation, and at the present time, 22 years and 6 months after the original operation, she was apparently cured.

The pathological report of the original tumor of the breast was wanting. The report of the pathologist, however, on the lump removed at the time of the second operation showed it to be a typical carcinoma. The same was true of the mass removed at the third operation.

This patient, who was now in her eighty-first year, stated that she felt perfectly well, and as almost 13 years had elapsed since her last operation, it was quite possible that she was permanently cured.

Dr. Johnson said he could not recall a case parallel to the one shown by Dr. Murray, where the patient had remained well for so long a period after the removal of the breast for carcinoma and in spite of a subsequent local recurrence above the clavicle. He had one case in mind where the patient remained well for 26 years, and then either had a recurrence or a car-

cinoma *de novo*—which it was he could not say. He, in common with others, had frequently been struck by the extraordinary difference in the degree of malignancy of tumors which appeared both macroscopically and microscopically to be identical. In a case of tumor of the breast which he removed about nine years ago he did not regard the growth as malignant, and simply removed the tumor without removing the breast. The pathologist reported that the growth was undoubtedly cancer, and still nine years had elapsed without signs of a recurrence.

Cases like the one shown by Dr. Murray, the speaker said, where the patients had remained free from recurrence after such long intervals, gave the surgeon new hope and encouragement in dealing with carcinoma of the breast.

Dr. W. S. Schley said that three years ago he operated on a woman 63 years old for a recurrent carcinoma of the breast which had been removed 13 years before. At that time both the breast and the axillary contents were removed, and the recurrence, which was about the size of a silver half dollar, occurred directly in the line of the scar, a purely local recurrence. Two years ago there was a second recurrence at the lower end of the old scar, and a year ago there was a third recurrence, also in the scar. This has progressed very slowly and has not yet been operated. The supraclavicular glands have apparently never been invaded.

During her earlier life, Dr. Schley said, this patient had been in very good physical condition and good circumstances, which perhaps had some influence upon the prevention of recurrences in carcinoma. In recent years she had been in poor circumstances, and, as a result, her health had suffered. The carcinoma had made its reappearance 13 years after operation, during the time of declining health and physical condition.

FOREIGN BODY IN ŒSOPHAGUS: ESCAPE INTO STOMACH AFTER INEFFECTUAL ŒSOPHAGOTOMY.

Dr. Frank W. Murray presented a man, 48 years old, who was seen early in the evening of February 12, 1911, some two hours after he had swallowed a gold plate to which were attached three artificial lower incisor teeth, the plate being fastened by bridge-work to the right canine tooth and the left incisor

tooth, respectively. The patient complained principally of pain low down in the neck, on the left side. There was no dyspnœa.

Upon introducing the index-finger into the pharynx, the foreign body could not be felt, and external palpation of the neck was equally negative. The patient was immediately sent to the New York Hospital, where an X-ray picture was taken, which showed the plate lying transversely in the œsophagus, at the level of the sixth cervical vertebra. With the patient's head in an over-distended position it was possible to grasp the plate between the jaws of a pair of long forceps, but all attempts at extraction were unsuccessful, as the plate was too firmly wedged in the œsophagus. An hour later, external œsophagotomy was done, and on introducing the index-finger through the incision in the œsophagus, the plate could not be felt. By means of a large bougie passed into the œsophagus through the wound, the foreign body was detected some three or four inches lower down, and from this point it was pushed into the stomach.

The œsophagus was closed with two layers of chromic gut sutures, and the wound in the neck was closed with the exception of its lower third, through which a small packing of sterile gauze led down to the œsophagus. For four days following the operation the patient was fed by means of nutrient enemata. A slight discharge from the wound appeared on the second day, which two days later became so copious that all sutures were removed and the wound was firmly packed with sterile gauze. The discharge continued to be very profuse for ten days, necessitating a frequent change of dressings, but when the patient left the hospital, 17 days after the operation, it had greatly diminished. Three weeks later the wound had entirely closed.

An X-ray picture, taken on the day following the operation, revealed the fact that the plate was still in the stomach, and a second picture, taken three days later, showed the plate in the cæcum. On the following day it was passed spontaneously. At the present time the patient was perfectly well, and experienced absolutely no difficulty in swallowing his food.

Dr. Arthur C. Vosburgh said that an interesting illustration of how large a foreign body could pass through the intestines had recently come under his observation. A man swallowed two silver half dollars. They were followed through the intestines with the X-ray, and were expelled spontaneously on the fourteenth day.

POSTERIOR CONGENITAL DISLOCATION OF THE LEFT SHOULDER.

Dr. J. M. Hitzrot presented a girl, eight years old. Three days after her birth her aunt noticed that she did not use the left arm as freely as the right. There was nothing abnormal about the birth, and no instruments were used. Since that time the child had used the hand freely, but was unable to raise it to her head.

Examination: The left arm was rotated inward. The elbow was forward with its point in front of the anterior plane of the body. The shoulder was flattened anteriorly and the acromion process prominent. Below and behind this prominence the head of the humerus could be seen and felt to rotate with the shaft. Abduction was limited to 45 degrees; external rotation to less than 10 degrees, and internal rotation to a still less extent. With a hand high in the axilla, the anterior surface of the glenoid could be palpated with the head of the bone behind it. The electrical reactions of the arm muscles were all normal, and no thickening could be felt in the region of the cervicobrachial plexus.

An X-ray negative showed a displacement of the head of the humerus, and a lack of growth of the neck of the scapula and the upper end of the humerus, as compared to the opposite side.

Operation December 12, 1911: An anterior incision was made over the shoulder-joint, and the deltoid and pectoral muscles separated. The deltoid was turned back as a flap by separating it from the clavicle and by cutting through a thin layer of the acromion with a chisel, and carrying this back with the muscle. The head was found rotated backward, the capsule small and stretched across the glenoid fossa. The subscapularis tendon was found at the lower level of the glenoid. The tendon of the long head of the biceps lay on the axillary side of the bone. The capsule was intact, and no tear could be found. It was so small and contracted that the head could not be reduced. The capsule was then freed from the humerus anteriorly. Thus the glenoid fossa was exposed and the head found resting on a facet on the posterior surface of that process, with the greater tuberosity close to the glenoid. The head was then freed by manipulation and replaced in contact with the glenoid fossa. After its replacement, it was found that the capsule was not large enough to cover the anterior surface of the head, and a flap from the

coracobrachialis tendon was used to cover in this defect. The deltoid was found to be too short, excepting when the arm was placed in abduction to the horizontal. The arm was placed in that position, and the severed acromion approximated by chromic gut sutures passed through drill-holes in that bone. The fascia, skin, etc., were closed with catgut, and the arm put up in moulded plaster splints in abduction to the horizontal. Convalescence was uneventful, and the result, now 43 days after the operation, showed the head in good position. The child could now place the hand on the head without difficulty when the splints, which it had not been considered wise to remove until seven weeks had elapsed, were removed for massage and passive motion.

ANTERIOR DISLOCATION OF THE LOWER END OF THE ULNA: LATE RESULT.

Dr. James M. Hitzrot presented a girl, a nurse in training, who in September, 1910, had her right hand caught in a moving dumb-waiter. The radius and ulna were squeezed together and the hand forcibly supinated before she could withdraw it. On examination, the hand was found in flexion at the wrist, the lower ulnar prominence was absent, and there was a distinct fulness beneath the tendon of the palmaris longus at the wrist. There was no active motion; any attempt at passive movement was extremely painful, and the range of motion was limited to the barest possible movement. Reduction, under an anæsthetic, was accomplished by flexing the wrist in full supination and forced radial flexion. In the above position, firm pressure was made over the displaced lower end of the ulna, at the same time slowly extending the wrist, and the bone slipped back in place with a distinct snap. A photographic print of the X-ray was exhibited, which showed the anterior displacement of the lower end of the ulna and a fracture of the ulnar styloid. The result now, 15 months after the injury, was perfect function at the wrist, without pain.

BILATERAL CYSTIC KIDNEYS: SIX YEARS' OBSERVATION.

Dr. Hitzrot presented a man, 47 years old, who came under observation six years ago for vague symptoms referred to the abdomen. During the routine examination, an epigastric hernia and bilateral enlargement of the kidneys were discovered.

The patient was operated upon by Dr. Hitzrot at Bellevue Hospital for the hernia, and the peritoneal cavity opened to palpate the kidneys, etc. During the course of this examination the kidneys were found to be cystic, the left kidney being larger than the right. At the same time, a large gall-stone was felt in the gall-bladder, and this was removed through the ordinary incision used for that purpose. Since that time the patient had been examined repeatedly, and the kidneys had been slowly increasing in size. In November the patient complained of a small lump at the lower end of the former incision for the epigastric hernia, and a small hernia was found there for which he was operated on at the New York Hospital. During this operation, the peritoneum was opened and the kidneys examined and found to have increased to about three times their size at the former operation. The surface of the kidneys was also more irregular, and the cysts larger in size. No cysts could be felt on the surface of the liver. The urine had shown no regular features; at times it contained a little albumin, and varied in specific gravity from 1010 to 1030. At no time was any blood present. The man has no general symptoms at present, his only complaint being occasional pain in the loins after any unusual work.

Dr. Hitzrot, in answer to a question, said there was no evidence of involvement of the liver in this case. The liver was perfectly smooth.

GAS BACILLUS INFECTION.

Dr. Hitzrot presented a man, 27 years old, who was admitted to the New York Hospital in the service of Dr. A. B. Johnson, on August 31, 1911, with the history of having been run over by a truck, the front wheel of which passed over his left lower leg, inflicting a long, lacerated wound which extended from the knee almost to the ankle, and exposed the tibia at about the mid-portion of the wound. He was kept in the reception ward until the day following, at which time he had a temperature of 104°; the wound had a gangrenous appearance and a peculiar sweetish-fetid odor. There was very little discharge. On pressure, gaseous crepitation was felt at the upper angle of the wound and gas could be squeezed from the lacerated surface. Under ether, the wound was widely opened and two long cuts

made in the thigh reaching above the crepitation. Formalin solution (12.5 per cent.) was then poured into the wound and allowed to remain in contact with the tissues for ten minutes, when it was neutralized with peroxide and a wet dressing of peroxide applied. The leg was kept wet with this solution.

The culture showed the *Bacillus aërogenes capsulatus* (Welch), and the streptococcus.

Dr. Hitzrot said this was the second case of gas bacillus infection to recover by this treatment in his experience without amputation, in both of which the above mentioned organisms were present. The presence of the streptococcus in wounds infected by the aërogenes had seemingly increased the virulence of that organism.

Dr. Robert T. Morris said that in one case of gas bacillus infection following a compound fracture of the radius in a boy, the process was kept under control as long as the entire limb was kept submerged in an antiseptic bath at body temperature. This was continued for some weeks, but an amputation at the shoulder finally became necessary because tissue repair would not progress in the bath. This was at the Post-Graduate Hospital. In another case upon which he operated at Mt. Vernon Hospital the infection also followed a compound fracture of the radius in a boy. In this case infection had extended to the pectoral region, but the patient finally recovered after a shoulder amputation, although the pectoral region was crackling with gas at the time of operation.

Dr. Lucius W. Hotchkiss said that his experience with cases of gas bacillus infection had led him to the conclusion that the degree and intensity of the infection depended not only upon the greater resisting power of the individual, but also upon the relative malignancy of the bacillus. Some years ago, at the Hood Wright Hospital, they had several cases of this infection, some following the subcutaneous injection of salt solution, which occasionally harbored these organisms. In those cases, the infection was relatively mild, and a simple wide incision sufficed. On the other hand, he could recall cases that were malignant from the start, and where general blood infection and death occurred very rapidly. He mentioned one case where the infection appeared on the passage of a sound five days after an external urethrotomy, and was rapidly generalized and fatal.

DR. HITZROT, in closing, said he thought the relative malignancy of the gas bacillus depended largely upon the presence or absence of the streptococcus. Those cases in which the latter was present in large numbers were the severe ones, in his experience. He had seen lacerated wounds in which the gas bacillus alone was present, which, except for their unhealthy appearance, caused no concern and produced no constitutional symptoms.

ANTERIOR DISLOCATION OF THE SEMILUNAR BONE.

DR. E. H. POOL presented a case of anterior dislocation of the semilunar in order to show the late results of the removal of that bone, the operation having been done in April, 1911. The patient was a teamster, 29 years old, who fell from a wagon two days before operation. The physical signs were typical, and the X-ray showed an absence of other lesion, such as fracture of the scaphoid. Reduction was impossible. The removal of the bone was accomplished without difficulty through an anterior incision, and the wound healed by primary union.

At the present time, the range of movements as well as the strength of the arm at the wrist were normal. All motions were painless excepting upon extreme adduction (ulnar flexion), which gave rise to pain immediately below the tip of the ulnar styloid. This was presumably due to the change in the relative positions of the carpal bones, whereby the cuneiform was brought closer to the tip of the ulnar styloid, against which it therefore impinged in extreme adduction. See X-ray. (Fig. 1.)

OLD SUBCORACOID DISLOCATION: OPERATIVE REDUCTION.

DR. POOL presented a woman, 41 years old, who on June 10, 1911, fell, injuring her right arm. When the patient was admitted to the House of Relief, four and a half months later, she complained of much pain in the arm. Examination and X-ray showed a subcoracoid dislocation of the humerus. Motion was very limited and the arm was weak. Efforts at reduction failed.

Operation: Through an anterior incision, the head of the bone was exposed. The biceps tendon was found to be displaced outward and backward, and was dissected free. The head could not be moved sufficiently for reduction until it was entirely freed from ligamentous attachments and the supra-

FIG. 1.

Anterior dislocation of the semilunar bone.

spinatus was cut. The posterior capsule was adherent to the glenoid and was excised, and the adventitious tissue removed from the glenoid cavity. After this, the head of the bone was readily returned to its normal position. The biceps tendon was sutured in its groove, and the anterior capsule was brought over the head as far as possible and its edges sutured to the deep surface of the deltoid, thus affording some protection for the head. Stab-wound drainage was established posteriorly, and the wound closed.

Healing was uneventful. Early massage and passive motion were instituted, and at the present time, three months after the operation, the head of the humerus was in its normal position, there was fair mobility independent of the scapula, showing that there was no ankylosis. With the aid of the scapula, the movements were much freer. Active motion showed 40 degrees of abduction without the aid of the scapula, and 90 degrees with it. There was rotation of about 20 degrees independent of the scapula; adduction was normal. The patient was able to place her hand on the top of her head, to the opposite posterior scapular line, and around to the small of the back. There was little or no atrophy, no shortening, and the strength of the arm was good.

This case, Dr. Pool said, raised the query whether in such a case the best functional result was to be obtained by replacing the head of the bone in its normal position, thus obtaining strength but limited motion, or by excising the head, thus obtaining greater freedom of motion at the expense of strength. It also suggested that the preservation of the anterior capsule as far as possible, and uniting its edge to the deep surface of the deltoid, was of advantage.

Dr. L. W. Hotchkiss said he had operated on a number of cases of old subcoracoid dislocation of the shoulder by arthrotomy with extremely satisfactory results, the functional results being very good. In a few cases, where he had resorted to excision of the head of the bone, the final results were also excellent. He preferred arthrotomy when practicable.

Dr. James M. Hitzrot said that in a recent article by J. Dollinger in the *Ergeb. d. Clin. u. Orthop.*, vol. iii, 45 cases were reported, of which 39 were treated by the open method with very favorable results. In none of these was the dislocation older than one year. He also quoted the statistics of Schultz

and Küttner, who found that after arthrotomy in recent dislocations of the shoulder, only 13 per cent. to 15 per cent. gave normal function.

Dr. Hitzrot said that in the Out-door Department of the New York Hospital they had under observation at present two old unreduced dislocations of the shoulder which were being treated by massage. The patients had fairly good use of the arm, and an open operation was not deemed advisable because it did not seem likely to increase the usefulness of the arm, and other than the limitation of function, the patients suffered no discomfort.

Dr. Walton Martin said that in two cases in which he had excised the head of the bone, the functional results were not as good as in the case shown by Dr. Pool.

PARTIAL GASTRECTOMY FOR CALLOUS ULCER NEAR PYLORUS.

Dr. Pool presented a man, 36 years old, who was admitted to the French Hospital on November 9, 1911, suffering from "indigestion and pain in the stomach." These symptoms dated back eight years; the pain radiated into the back and was relieved by the eructation of gas. He had been a heavy eater until four weeks before his admission, when his epigastric pain had become more constant and he had been able to eat but little on account of the exaggeration of the pain which he experienced for an hour or two after eating. He had vomited occasionally after taking food and suffered from chronic constipation. His weight on admission was 153 pounds.

An examination of the blood showed 4,500,000 red cells, with 74 per cent. of hæmoglobin. The stools were negative for blood. The stomach had a capacity of 1200 c.c. An examination of the stomach contents showed much mucus, with free acid 52, a faint trace of lactic acid, and a total acidity of 86; no blood. The X-ray pictures which were taken after the administration of bismuth were inconclusive.

Operation, November 16, 1911: The abdomen was opened through a high median incision, and an examination of the stomach disclosed a hardened area about one inch in diameter close to the pylorus on its posterior surface and lesser curvature. From this dense area the sensation of infiltration gradu-

ally faded. The entire pyloric region was covered by dense adhesions.

The impossibility of safely infolding or resecting the indurated area on account of adhesions to the pancreas, the danger of present or subsequent malignancy, and the advantage of an occluded pylorus with a gastrojejunostomy led Dr. Pool to decide upon resection. The pyloric end of the stomach was extensively resected, the lines of the incision sutured, and a posterior gastroenterostomy performed. No difficulties were encountered with the exception of the dissection of some dense adhesions to the pancreas.

The patient's post-operative course was uneventful, and he was discharged on the twenty-fourth day. His present weight was 183 pounds, and he was able to eat any kind of food.

The specimen showed a depressed ulcer on the posterior wall of the stomach, close to the pylorus. Its edges, which were raised, were as firm as cartilage, the induration gradually fading into the surrounding tissue. Many sections had been examined and showed no evidence of carcinoma. The induration was due largely to extensive thickening of the submucosa adjacent to the ulcer as the result of the formation of new connective tissue. The muscularis likewise presented extensive small, round-celled infiltration.

Dr. George Woolsey said he thought Dr. Pool was entirely justified in removing a part of the stomach in the case he reported. The speaker said that in the last three of his own cases where he did a gastrectomy for callous ulcer of the pylorus, two of them, on microscopic examination, proved to be carcinomatous.

PARTIAL GASTRECTOMY FOR CARCINOMA.

Dr. Pool said he showed this case on account of the persistent regurgitant post-operative vomiting, which cleared up under conservative treatment.

The patient was a woman, about 60 years old, who complained of pain in the epigastrium radiating to the left shoulder and left iliac region, and very sharp and severe in character. It was at first relieved by taking food, but later it became quite constant and more severe at night when she was in the prone position. There was no history of vomiting; the appetite was

poor; she was constipated and had lost about 20 pounds in weight during the previous three months. Palpation revealed a hard mass in the region of the greater curvature of the stomach, in and to the left of the median line.

Operation: On the anterior wall of the stomach near the greater curvature there was found a characteristic carcinoma. There were no enlarged lymph-nodes, excepting one near the tumor on greater curvature. A partial gastrectomy was done, and the lines of resection sutured. The stomach pouch was very small, and to complete the posterior gastrojejunostomy it was necessary to exert some traction on it. The anastomosis was difficult, as the parts to be sutured could not be brought to the surface of the wound. It was evident that the operation was defective in respect to the size of the stoma, and possibly as a result of kinking of the intestine by reason of the ascent of the stomach when traction upon it was released after completing the stoma.

There was persistent post-operative regurgitant vomiting, which began the day following the operation. Saline solution was administered per rectum, but it was not retained. Hypodermoclysis was thereupon substituted. Nutritive enemata were at first largely expelled, but were later retained. The vomitus was brown and fecal-like with an offensive odor. There were no indications of peritonitis, and the bowels moved readily after calomel. The obstruction was evidently not complete and it seemed likely that the operative defects would be adjusted and compensated for if the nutrition could be maintained and autointoxication prevented for a reasonable time. Lavage was begun on the third day. The patient continued to vomit from three to eight times daily, and regurgitated constantly. The stomach was washed out twice daily, and after each washing peptonized milk was introduced. Some fluid was found in the stomach at each washing. About the fourteenth day the vomitus changed to a dark green color; it gradually became lighter in color and less frequent, and ceased on the twentieth day. Lavage was continued for five weeks. The diet had been gradually increased, and the patient was now able to eat practically anything and was in good condition and free from pain.

Examination of the tissues showed carcinoma, including the adjacent node in the greater curvature.

CONGENITAL PYLORIC STENOSIS: GASTRO-ENTEROSTOMY (TWO CASES).

DR. WILLIAM A. DOWNES presented a male infant, three weeks old, who was admitted to the Babies' Hospital on November 23, 1911, with the history of vomiting and constipation. It was the first child, born at full term and the birth was normal. The mother had had no miscarriages, and the family history was negative. The child had been breast fed up to the present time.

The history obtained was that the child had commenced vomiting twelve days before admission, when it was eleven days old. The vomiting, apparently, had no definite relation to feeding; it occurred sometimes immediately after feeding, sometimes one or two hours later, and was frequently forcible in character. The stools were green and slimy for several weeks prior to admission, and there was no movement of the bowels unless an "injection" was resorted to. The weight of the child on admission was six pounds, three and a half ounces; it had a fairly good color, but was considerably emaciated. A marked peristaltic wave was present, and a tumor the size of an English walnut could be palpated in the right hypochondrium.

A special diet was ordered, but in spite of this the vomiting persisted and the child became extremely prostrated and continued to lose weight. On November 27, four days after admission, an operation revealed a congenital hypertrophic stenosis of the pylorus, and a posterior gastro-enterostomy was done. Following this, the vomiting gradually grew less frequent and severe, and there was more substance in the stools. Since the child left the hospital, on December 19, it had vomited only twice, and the stools were those of a healthy nursing baby. Its present weight was over nine pounds.

Dr. Downes presented a second case in the person of a male infant, seven weeks old, who was admitted to the Babies' Hospital on December 7, 1911, with the complaint of vomiting and constipation of two weeks' duration. He was the fourth child, born at full term after a normal labor, and had been breast fed until two days before. The family history was negative; there was no history of miscarriages. The baby had apparently been healthy at birth and had gained in weight until two weeks ago. When it was five weeks old, the vomiting had suddenly set in; it was projectile in character and occurred after each feeding.

Constipation had been persistent, with rapid loss of weight. Upon admission to the hospital, the child weighed seven pounds, eleven and a half ounces. The vomiting persisted in spite of special diet, and on December 9 the abdomen was opened by Dr. Downes and a stenosis of the pylorus was found, similar to that in the first case. A posterior gastro-enterostomy was done. On the day after the operation, the temperature ranged between 100° and 103.4°, but on the fifth day became normal. The vomiting gradually became less severe, and seven days after the operation it ceased entirely. The stools became normal in appearance and the child was discharged on January 1, 1912. Since then there had been no vomiting; the baby was nursing well and gaining in weight.

Dr. Downes, in reply to a question as to the frequency of congenital pyloric stenosis, said that while he was unable to give the exact figures, the records of the Babies' Hospital showed that they had had about 35 cases in the past 6 years out of 5000 children admitted, not all proven, however, by operation or autopsy.

In both of his cases, Dr. Downes said, he did a posterior gastro-enterostomy without clamps, and in connection with this procedure he called attention to the importance of not making the opening in the intestine too large, as that interfered seriously with the anastomosis and unduly prolonged the operation. In order to avoid having the opening in the intestine larger than in the stomach, two guy stitches approximating the stomach wall and intestine were placed so that the first one, including the stomach and intestine walls, was held taut, while the second was passed through the stomach wall and the intestine, then put upon the stretch before the stitch was passed. In this way with care the two openings can be more nearly made of same size, and the difficulty in completing the suture due to redundancy of intestinal mucous membrane much lessened.

ŒSOPHAGEAL DIVERTICULUM: RESECTION OF ONE INCH OF CERVICAL ŒSOPHAGUS: END-TO-END SUTURE.

DR. DOWNES presented a woman, 34 years old, who was admitted to the New York Hospital on July 6, 1911. She gave a history of pneumonia nine years ago, but had otherwise enjoyed good health up to two and a half years ago, when she began to

regurgitate her food and experience increasing difficulty in swallowing. While talking, coughing, or laughing, mucus and food would suddenly "fly" out of her mouth. There was also increasing loss of weight.

An examination showed that an œsophageal bougie passed 8½ inches from the teeth, and after the introduction of bismuth mixture, the X-ray showed a typical diverticulum situated at that point.

Operation, July 8, 1911: An incision was made along the anterior border of the left sternomastoid, from the angle of the jaw to the clavicle. The diverticulum was easily exposed and cut away after the application of a clamp. When this was done it was immediately noticed that the entire œsophagus had been divided with the exception of a strip about a quarter of an inch wide on the right lateral wall, and there was no alternative but to complete the division and bring the divided ends together with mattress sutures of chromic gut. This was accordingly done, and a catheter was inserted into œsophagus and left there. The wound was then partially closed, with drains down to the lower angle and the line of sutures. Feeding was carried on through the catheter. Considerable infection followed the operation, with burrowing abscesses which extended down behind the clavicle. These were emptied by the suction method.

The patient was able to sit up by July 20, and the catheter was removed three days later. The patient's further convalescence was slow and rather stormy, and she was discharged, cured, on October 12, 1911. She is now able to eat any and all kinds of food, has gained 20 pounds in weight. Ten days ago No. 34 bougie was passed with perfect ease.

The excuse offered for making what appeared at the outset to be a simple case into one of such serious nature is that too much reliance was placed upon the X-ray plates. Side view gave the impression that the opening in the diverticulum was quite narrow, and with this in mind, when the sac was exposed, even though the base seemed rather wide, a clamp was placed in such a way that it seemed that the wall of the œsophagus was not being encroached upon and that after excising the sac it would be an easy matter to close the opening with continuous sutures. However, it was immediately apparent that practically the entire œsophagus for one inch had been cut away. The

opening in the diverticulum had involved the anterior and posterior as well as left lateral walls. If he had properly exposed the œsophagus by raising it from its bed perhaps the extent of the opening would have been appreciated. And again the case would have been simplified had he made an opening into the diverticulum and explored before proceeding to excise it, but this was purposely avoided, hoping to prevent infection.

LARGE EMBRYONAL ADENOCARCINOMA OF THE KIDNEY: NEPHRECTOMY.

DR. DOWNES presented a woman, 34 years old, the mother of four children. When she was admitted to the hospital, on July 13, 1911, she gave a history of having suffered from asthma for the past ten years; otherwise, her health was excellent up to one year ago, when she began to suffer from pain in the right lower abdomen. After the birth of her last child, ten weeks ago, her physician noticed a well-defined swelling on the right side of the abdomen. This had gradually increased in size, and the pains had become more severe. The patient had begun to lose weight. There were no urinary symptoms excepting the passage of bloody urine on one occasion about three or four months ago.

Examination showed that the right side of the abdomen was occupied by a nodular tumor extending from well up under the ribs to the crest of the ilium. It was movable; not tender.

July 18, 1911, an exploratory incision was made through the right rectus by another surgeon, encountering a tumor which was so large that on account of the condition of the patient it was not deemed advisable to attempt its removal. After recovering from the effects of this operation, the patient was sent to the country for four weeks, and upon her return, the tumor was removed by Dr. Downes through a transverse incision, extending from the erector spinæ muscle to the outer margin of the rectus. The growth proved to be an enormous embryonal adenocarcinoma of the kidney. The patient made a rapid and uneventful convalescence.

LARGE HYPERNEPHROMA: NEPHRECTOMY.

DR. DOWNES presented a man, 46 years old, who was admitted to the House of Relief on March 16, 1911. He gave a history of having had typhoid fever sixteen years ago, but had

otherwise enjoyed good health until September, 1910, when he noticed that he passed small quantities of blood *per urethram* at intervals of two or three weeks. Shortly afterward, he felt a tumor in the left side of the abdomen, and about the same time he began to suffer from frequent micturition, especially at night. His general health was apparently not impaired.

Upon admission, an examination showed that the entire left upper quadrant of the abdomen was occupied by a smooth, solid growth. The urine contained many red blood-cells and a few pus-cells. The blood count was normal.

Operation, April 4, 1911: The abdomen was opened through a transverse incision, through which a large hypernephroma was removed. The patient made an uneventful recovery.

These two cases were shown by Dr. Downes in order to illustrate the value of the transverse incision for the removal of large tumors of the kidney.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held January 8, 1912.

The Vice-President, Dr. Gwilym G. Davis, in the Chair.

TUMORS OF THE MALE BREAST.

Dr. John Speese read a paper with the above title, for which see page 530.

Dr. John H. Gibson said that during the last ten years he had operated upon four cases of tumor in the male, a comparatively rare disease, and as these four cases present a variety of tumors he detailed their histories, as follows:

In 1903 at the Pennsylvania Hospital he had a patient, a man 21 years of age, a shoemaker, who said that in his work he was accustomed to putting the leather against his chest and cutting it. This man had had a tumor for one month, hard, and with glandular involvement in the axilla. The growth appeared at the time of operation to be malignant, and he therefore removed the breast, the pectoral fascia, and glands of the neck, but not the muscles. The pathological report was adenofibroma. The axillary glands were inflammatory.

In 1910, at the Jefferson Hospital, he operated upon an elderly man who had had a tumor for seven or eight years, undoubtedly carcinoma, and it was so reported by the laboratory. The growth had ulcerated and involved the nipple and an area around it. He made a complete excision and used the X-ray afterward.

In May, 1911, he had another patient, a man 66 years of age, who had a large tumor of the breast, movable, ulcerated, which had existed for a number of years and had been treated in London by a quack with caustic. This proved to be a spindle-celled sarcoma. This man had a number of tumors over the body, which appeared to be lipomata, and it was thought that

this tumor of the breast might have begun as a lipoma and undergone that rare change to sarcoma as a result of the irritation of the treatment received, but Dr. Longcope, who examined the specimen, did not agree in this, thinking the growth had begun as a sarcoma.

Dr. Gibson had another case in an adult, a physician 73 years of age, who had a hard tumor in the left breast which was quite pendulous, the tissues being very flabby; he was quite sure it was a malignant growth, though there was no glandular involvement. The man suffered at the time from a very bad cardiac disease, from which he died suddenly a few years later. He had had a number of attacks, and Dr. Stengel advised against the use of a general anæsthetic, and therefore the breast was removed under infiltration anæsthesia. The growth proved to be a fibro-adenoma of the diffuse type. There was no recurrence. He had operated on one case of tuberculosis in the breast in the male, the patient being admitted to the Jefferson Hospital with this diagnosis. The breast was amputated. This man had previously had both testicles removed for tuberculosis.

Dr. Edward B. Hodge said the case of his mentioned by Dr. Speese was the only one he had operated on. It was interesting from several standpoints, one of which was the previous history of mastitis. This had been entirely forgotten by the patient. He had had several definite attacks of inflammation of the gland with discharge from the nipple, beginning at 15 years of age and reappearing at varying periods. He was 55 years of age when seen by Dr. Hodge. He had also been impressed by the great difficulty of covering in the space left after doing a complete operation on men because of the lack of adipose tissue over the breast.

Dr. William L. Rodman agreed as to the rarity of benign neoplasms in the male breast. He had seen but two such cases, one of rather extensive fibro-adenoma, in a man about 35 years of age, which proved benign in character; another in a young boy who had been struck in the left breast with a base-ball. This patient was about twelve years of age and the appearance of the breast, especially the enlarged veins, was quite suggestive of sarcoma. A clinical diagnosis of probable sarcoma had been made, but after removal it turned out to be inflammatory. He had never seen a sarcoma in the male breast. He had, however, seen nine cases of carcinoma in the male breast, three of

these in negroes. The first case he ever saw was at the Jefferson Hospital in 1879 or 1880 in a negro. The point he wished to emphasize—one which had already been mentioned by Dr. Speese—is that the time at which carcinoma in the male breast appears is considerably later than in the female. Furthermore, he thought that trauma as an etiological factor is far more important in cancer of the male than it is in cancer of the female breast. In two of his cases seemingly a direct connection between trauma and the growth appeared certain. One was a shoemaker who was in the habit of resting his last against the left breast; the other was in a laborer who in using the shovel was in the habit of resting it on the breast in his work. Operations for cancer in the male breast should give a better result than similar conditions in the female.

SUTURE OF FRACTURE OF BOTH PATELLÆ, UNDER INFILTRATION ANÆSTHESIA.

Dr. Charles F. Nassau reported the history of a man, aged 65 years, who, on October 3, 1911, slipped on a muddy street and fell, sustaining transverse fractures of both patellæ. He was a man with advanced arteriosclerosis, and he had been for some time under the care of Dr. George DeSchweinitz who was treating him for a grave eye condition. The patient's blood-pressure was very high and he had albumin in his urine. He was an extremely intelligent man who readily grasped the danger of a general anæsthetic. His consent and co-operation were obtained to operate under infiltration anæsthesia.

Operation was on October 9, 1911: The infiltrating solution was made by dissolving one tablet in 50 c.c., and one tablet in 100 c.c. of normal salt solution. Each tablet contained cocaine, gr. ¾, adrenalin, gr. 1/400.

A skin flap was raised in exposing each patella. The right patella was drilled and sutured with very heavy silver wire. On the left side a heavy braided silk suture was placed around the fragments without drilling. Both wounds closed without drain. Silver leaf dressing.

The post-operative course was uneventful. Healing perfect. At this date, 12 weeks after operation, the patient writes that he can walk 8 to 10 blocks daily without pain or fatigue. There is a full range of motion in both knees.

Dr. John H. Jopson said that while he had not wired any patellæ under local anæsthesia, yet in one patient he sutured the quadriceps tendon to the patella, it having been torn from the bone. This old lady had advanced cardiac disease, she could not lie down, and suffered from more or less continuous dyspnœa, so that he did not dare give a general anæsthetic and used local anæsthesia, opening the joint during the operation practically as freely and widely as did Dr. Nassau. The patient made a rapid and complete recovery, however, without any infection of the wound.

Dr. George G. Ross said that local anæsthesia is a method often condemned because the man who is using it does not know how to use it correctly. He had used it in many instances, such as in the removal of bunions, whitlows, and minor surgery, with satisfactory results except in two instances. One of these was a healthy young woman with a lipoma of the shoulder; she was very much afraid of ether and he consented to operate under a local anæsthetic. She had a violent convulsion. Another case was a man 58 years of age with a large bunion. He injected the area with a 1 per cent. solution of cocaine, using, he should estimate, between 25 and 30 drops by the infiltration method. The man inside of two minutes had a violent convulsion. He finally made a good recovery though he was mentally disturbed for twenty-four hours. In these two cases the results might have been due either to the strength of the solution or to the idiosyncrasy of the patients.

The speaker had had experience with quinine solution in six cases. One was an amputation of the toe, the other five were circumcisions. He concluded not to try it again owing to the extremely bad results obtained; the wounds sloughed over a long period of time and behaved very badly.

Dr. Charles F. Nassau (in closing) said that one should avoid the use of strong solutions of cocaine. A 1 per cent. solution of cocaine is strong enough under any circumstances. Too strong solutions, and also the use of tablets picked up indiscriminately from a table in the operating room which may have been handled by nurses, are more often the sources of infection than any inherent qualities in the tablets. The tablets he used are sterilized in little vials by dry heat, and he had never seen any wound where he had used them become infected.

OPERATION FOR ANEURISMAL VARIX OF THE POPLITEAL VESSELS.

DR. J. CHALMERS DACOSTA read a paper with the above title, for which see page 593.

DR. G. G. DAVIS said that this case was somewhat similar to one which came under his notice not long ago. The patient was a child 7 years of age, who, when about 3 years old was being circumcised. From some movement of the child the knife, which was lying on the abdomen, penetrated the thigh and wounded the femoral artery; a surgeon was called in and he ligated the femoral artery. About four years passed when the case came under his notice; it illustrates very clearly the effect of this condition on the growth of the limb. The size of the limb was very distinctly increased. The evidences of arteriovenous connection were very apparent; one could get the thrill and murmur and could see the pulsation approximately at the apex of Scarpa's triangle. The child is active, running about, but has a marked disproportion between the limbs, the injured one being three-quarters inch longer than the other, and one inch greater in circumference, showing the influence of this condition upon the nutrition. One would expect that the nutrition of a part was best carried on by the normal arrangement, but according to this case it would hardly seem so.

DR. JOHN B. ROBERTS said that it had long seemed to him that the nomenclature of this condition was bad. We say arteriovenous aneurisms or aneurismal varix and varicose aneurism. Years ago he suggested that it would be much better if they were called arteriovenous fistulæ. Simple arteriovenous fistula and sacculated arteriovenous fistula were the names which he then suggested. There is a similarity to aneurism, but that term should be restricted to a tumor made up of coats of an artery.

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